US009206650B2

(12) **United States Patent**
Lakic

(10) **Patent No.: US 9,206,650 B2**
(45) **Date of Patent: Dec. 8, 2015**

(54) **APPARATUS FOR DRILLING FASTER, DEEPER AND WIDER WELL BORE**

(76) Inventor: **Nikola Lakic**, Indio, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 779 days.

(21) Appl. No.: **13/424,184**

(22) Filed: **Mar. 19, 2012**

(65) **Prior Publication Data**

US 2012/0292112 A1 Nov. 22, 2012

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/US2010/049532, filed on Sep. 20, 2010.

(60) Provisional application No. 61/276,967, filed on Sep. 19, 2009, provisional application No. 61/395,235, filed on May 10, 2010, provisional application No. 61/397,109, filed on Jun. 7, 2010.

(51) **Int. Cl.**

E21B 4/00	(2006.01)
E21B 7/00	(2006.01)
E21B 10/26	(2006.01)
E21B 17/18	(2006.01)
E21B 21/01	(2006.01)
E21B 21/12	(2006.01)

(52) **U.S. Cl.**

CPC ***E21B 10/26*** (2013.01); ***E21B 7/002*** (2013.01); ***E21B 7/005*** (2013.01); ***E21B 17/18*** (2013.01); ***E21B 21/01*** (2013.01); ***E21B 21/12*** (2013.01)

(58) **Field of Classification Search**

CPC E21B 21/08; E21B 21/12; E21B 21/00; E21B 17/18; E21B 10/18; E21B 10/38; E21B 17/203; E21B 4/02; E21B 7/068; B08B 9/035

USPC 175/215, 25, 339, 320, 102, 324

See application file for complete search history.

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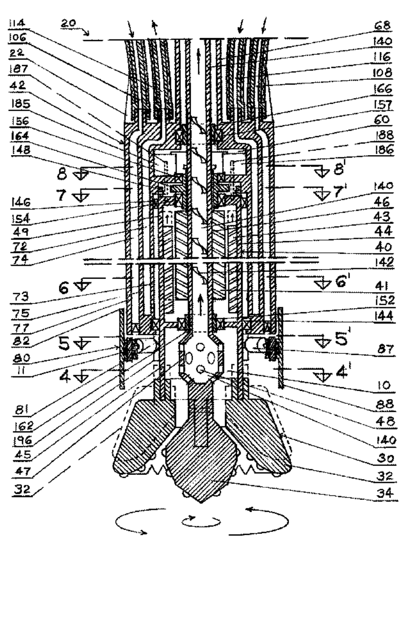
Primary Examiner — Daniel P Stephenson

(74) *Attorney, Agent, or Firm* — Schmeiser, Olsen & Watts LLP

(57) **ABSTRACT**

An apparatus and method for drilling deeper and wider well bores is provided. The apparatus includes a motorized drill head for cutting and shredding ground material; a separate excavation line; a separate fluid delivery line; and a separate close loop engine cooling line. The excavation line consists of multiple connected stationary segments of the main pipe with periodical segments of an in-line excavation pump. Alternatively, in another embodiment, excavation line consists of multiple connected segments of the main stationary pipe with rotating continues screw inside. The close loop cooling line consists of one heat exchanger in the motorized drill head and one on the ground surface in the binary unit where fluid is cooled and in process electricity produced which can be used as a supplement for powering drill head, pumps, equipment, etc.

29 Claims, 39 Drawing Sheets



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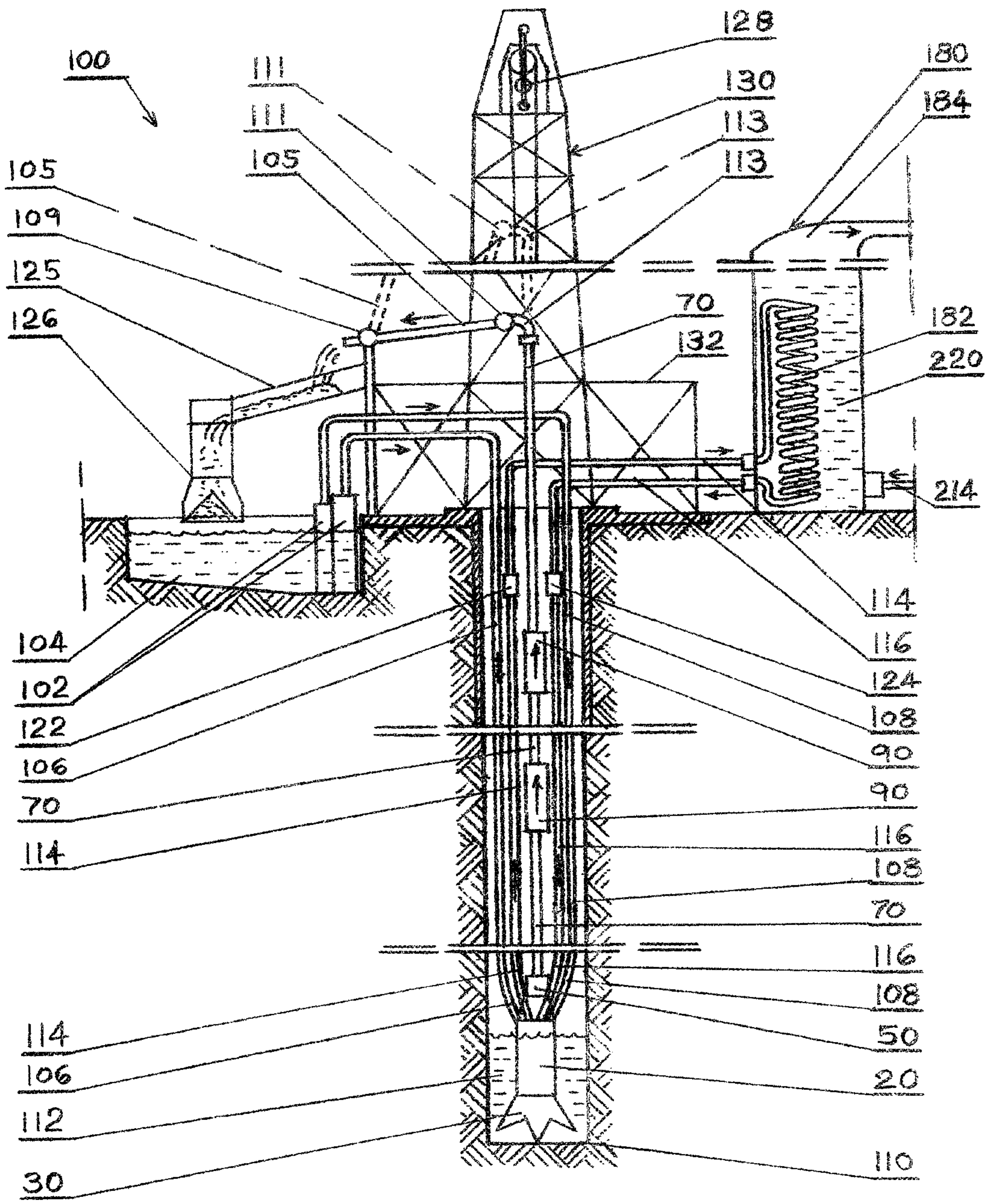
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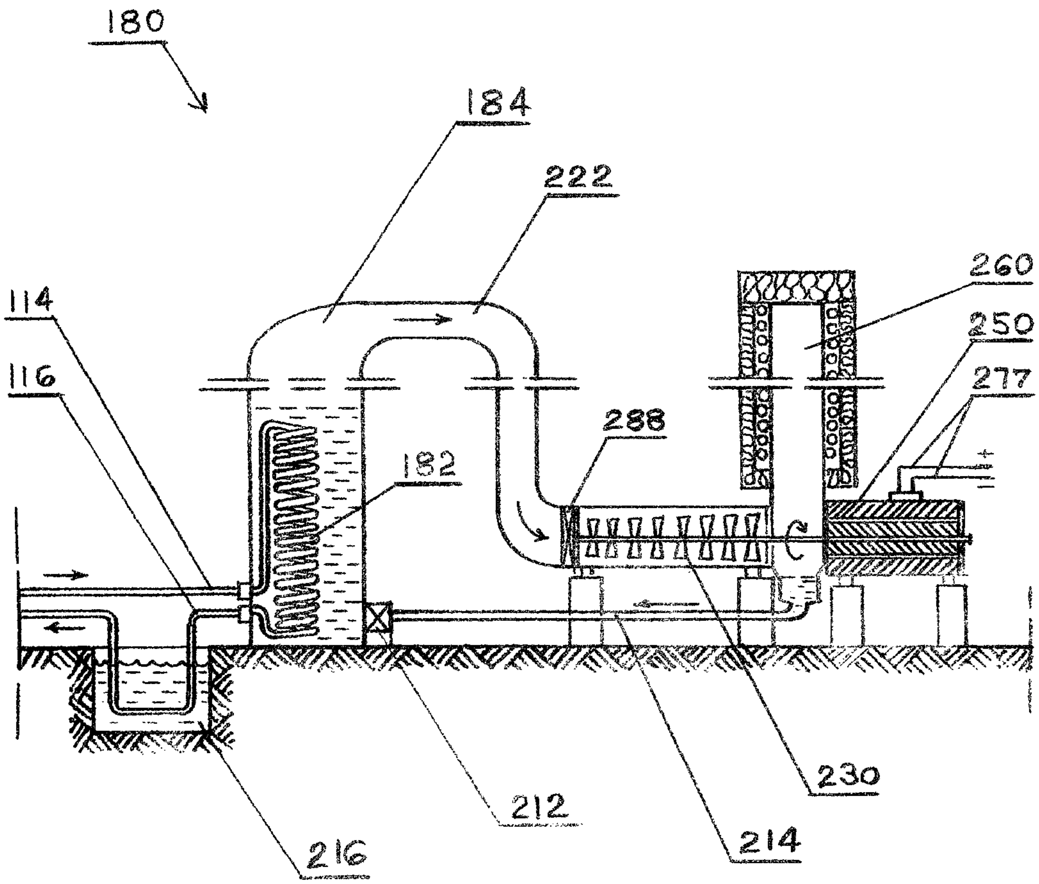
FIG. 1



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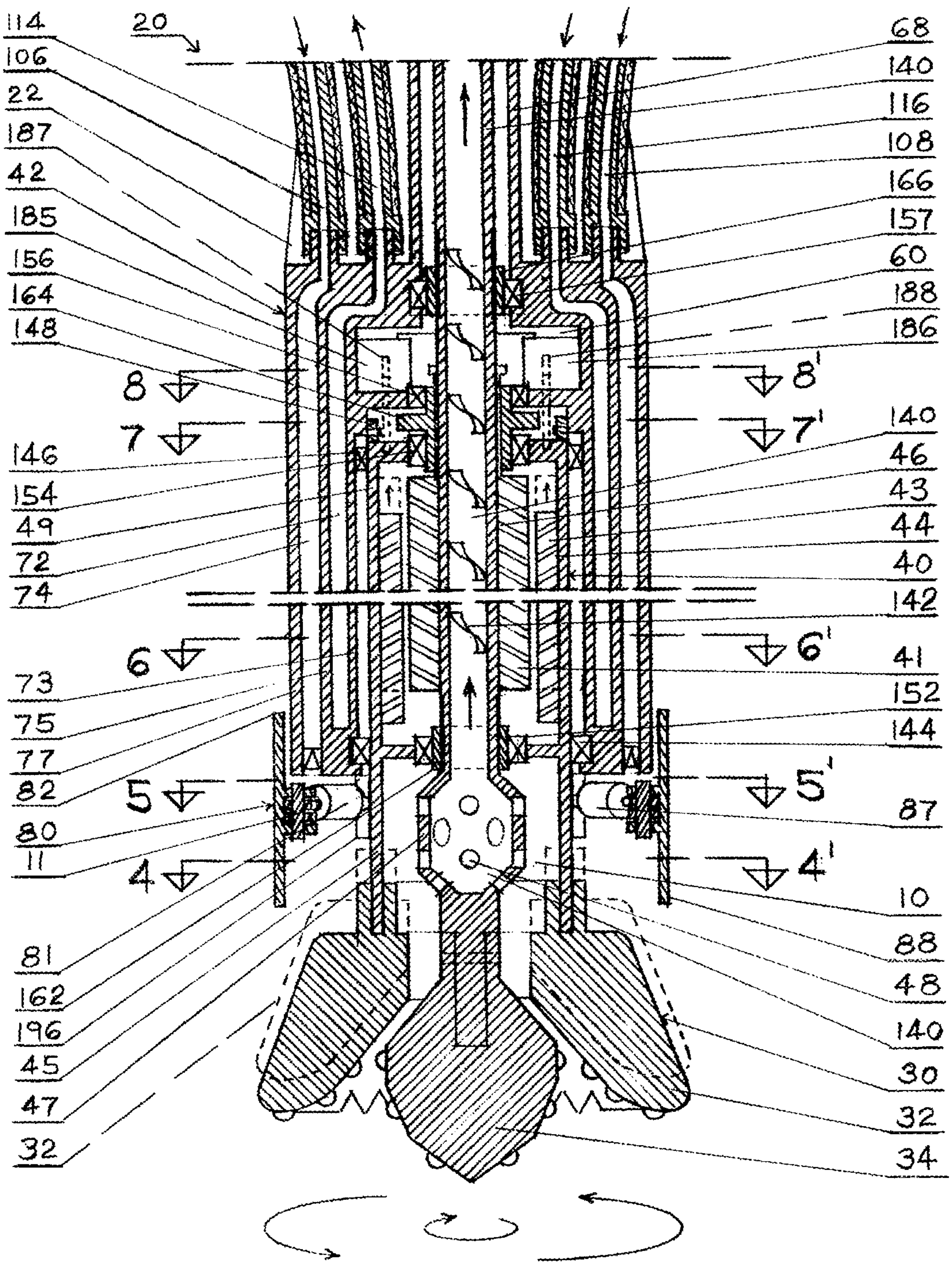
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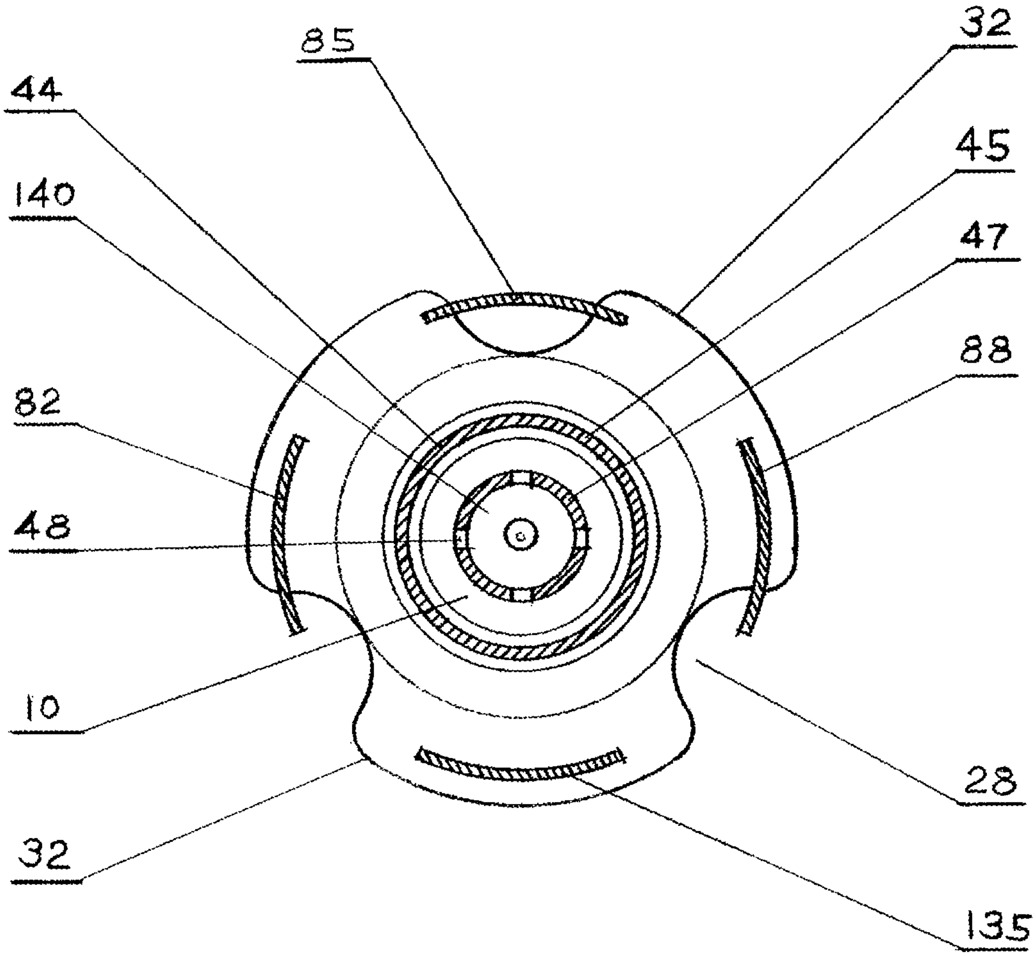
FIG. 3



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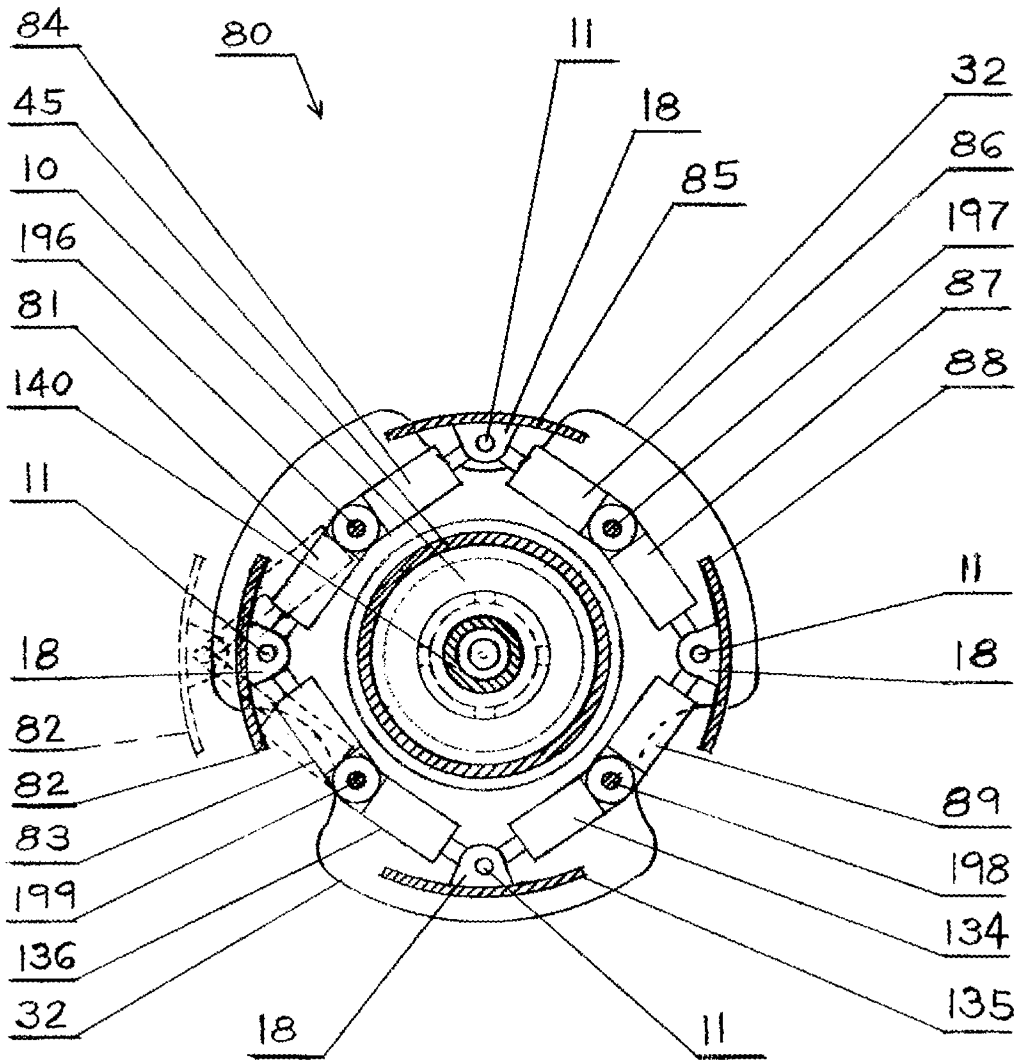
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FIG. 5

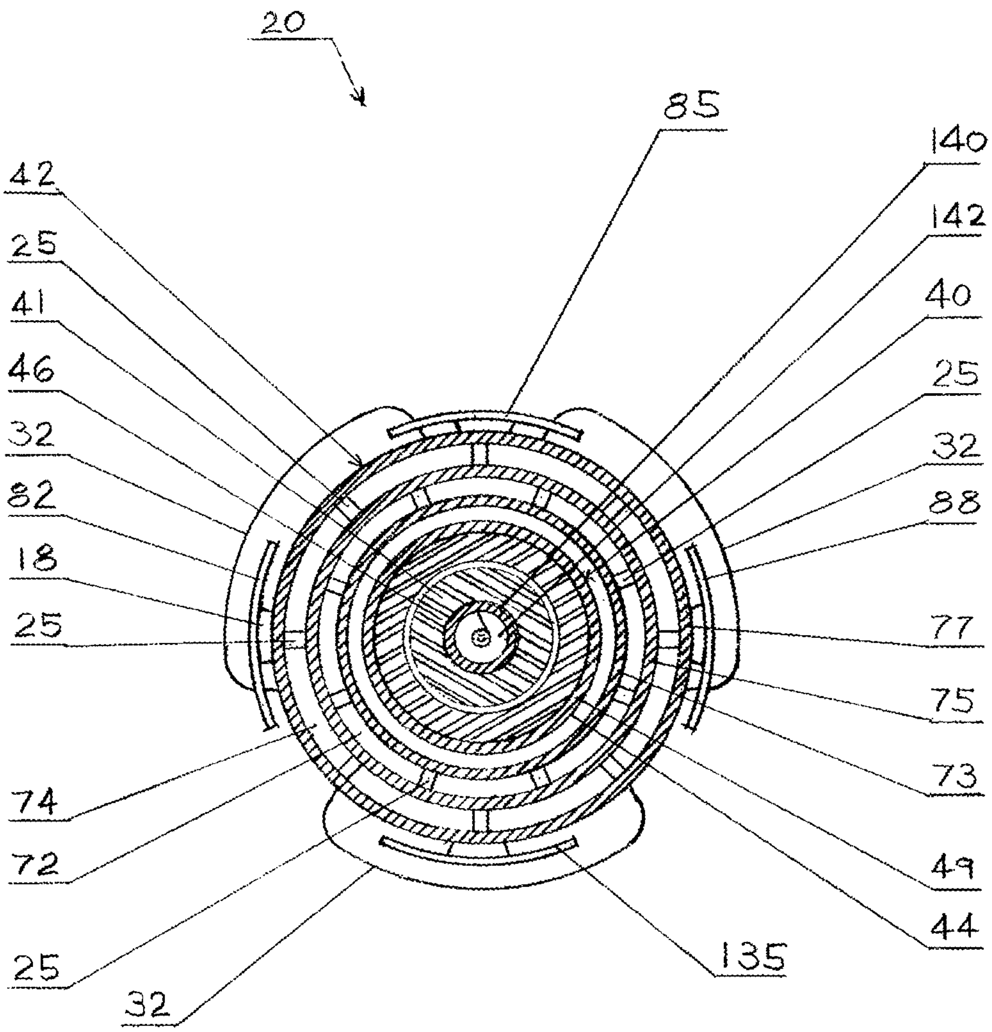
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FIG. 6

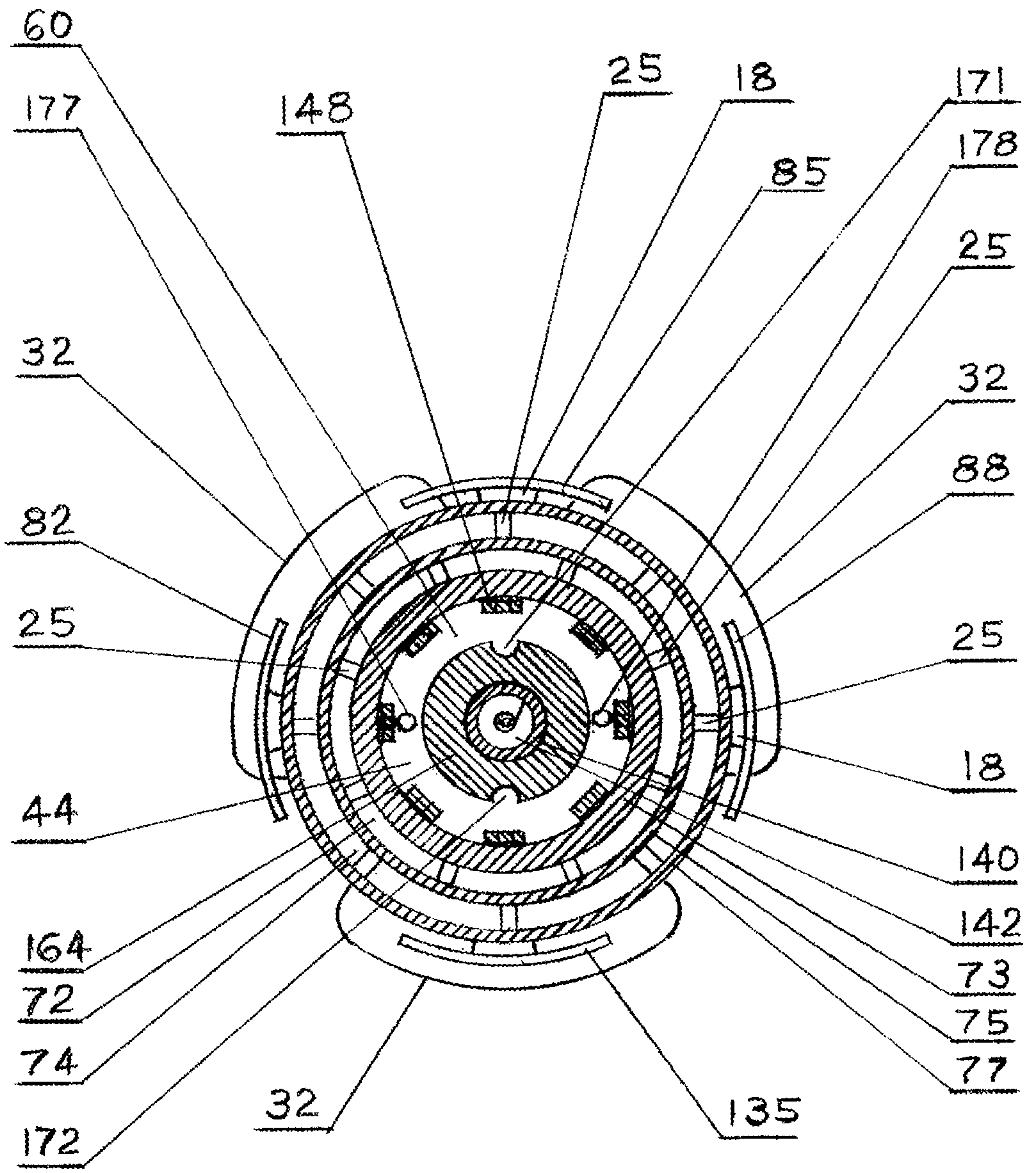
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FIG. 7

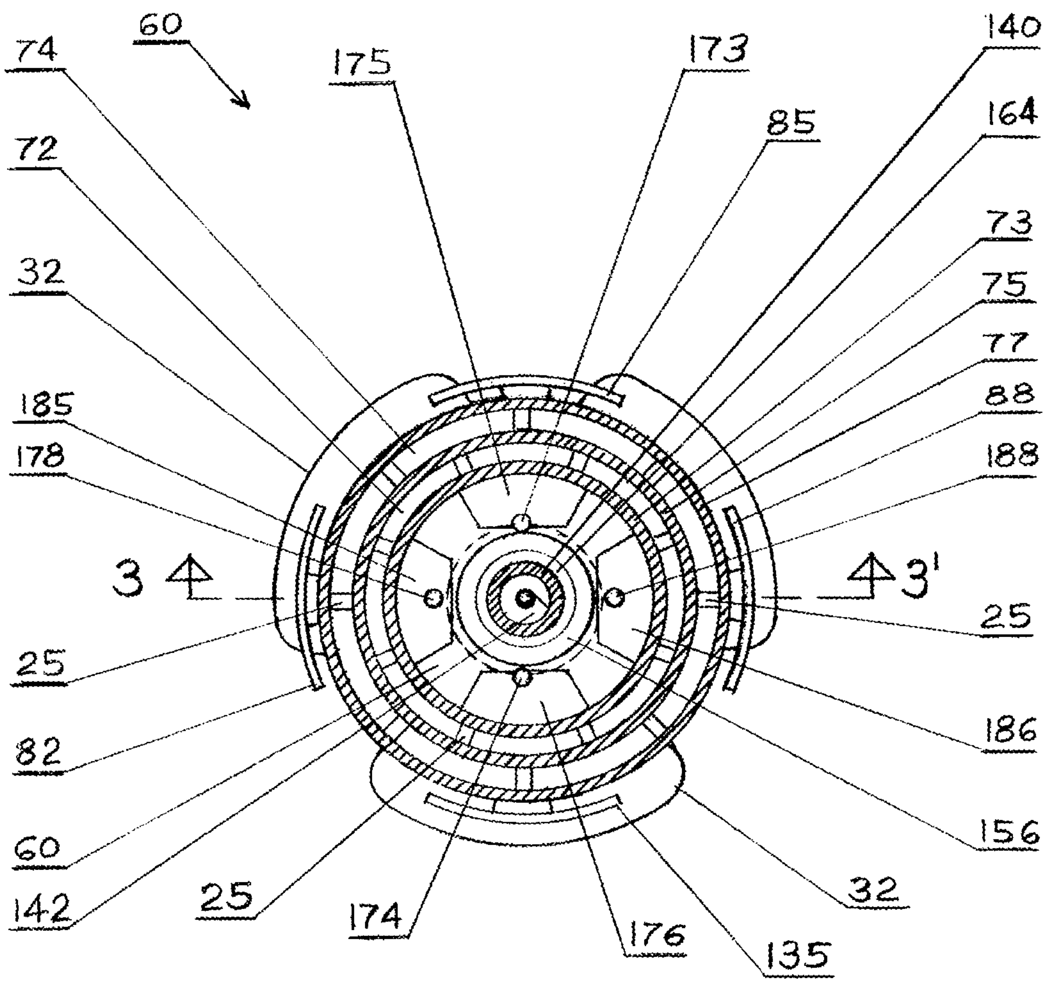
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FIG. 8

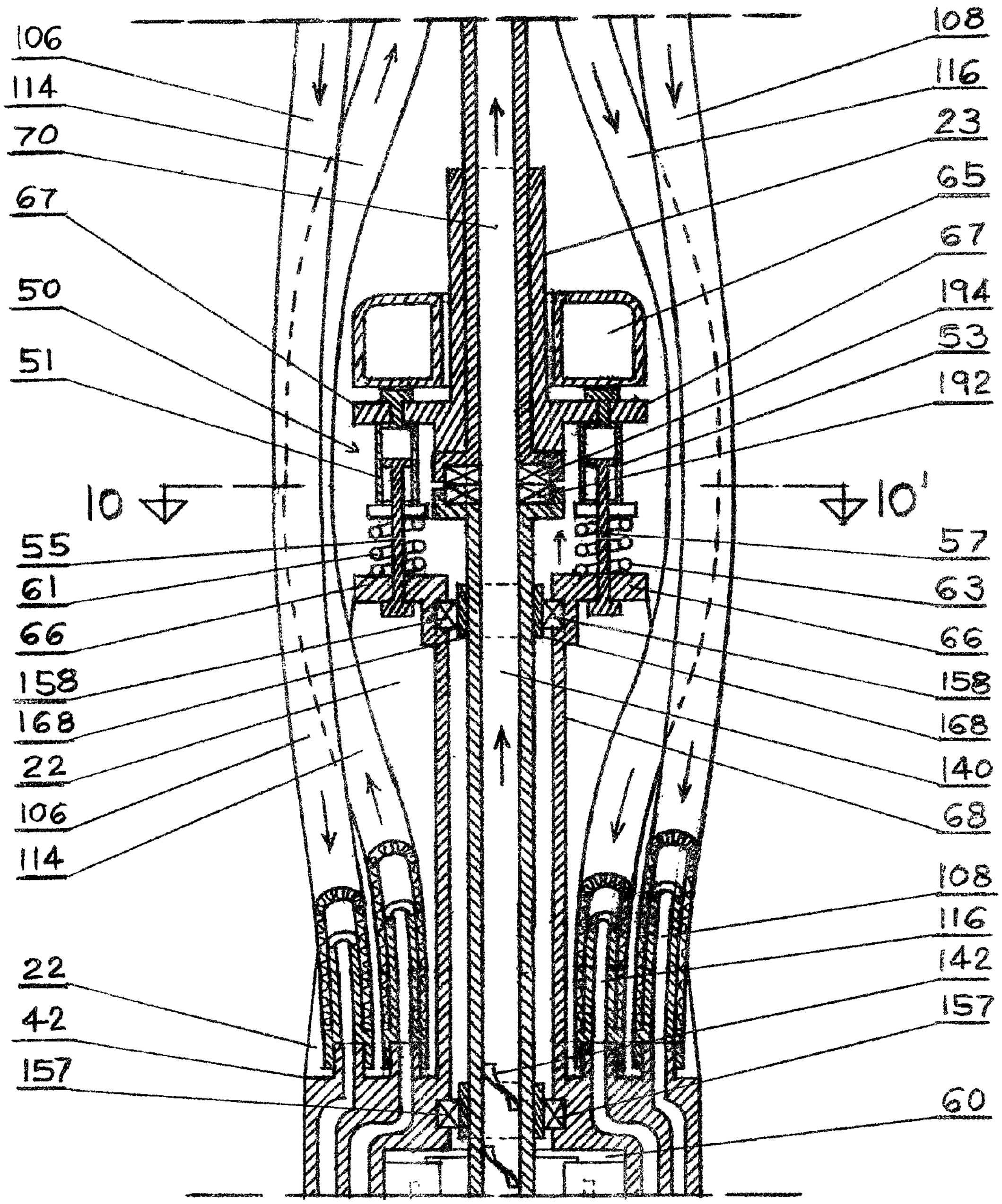
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FIG. 9

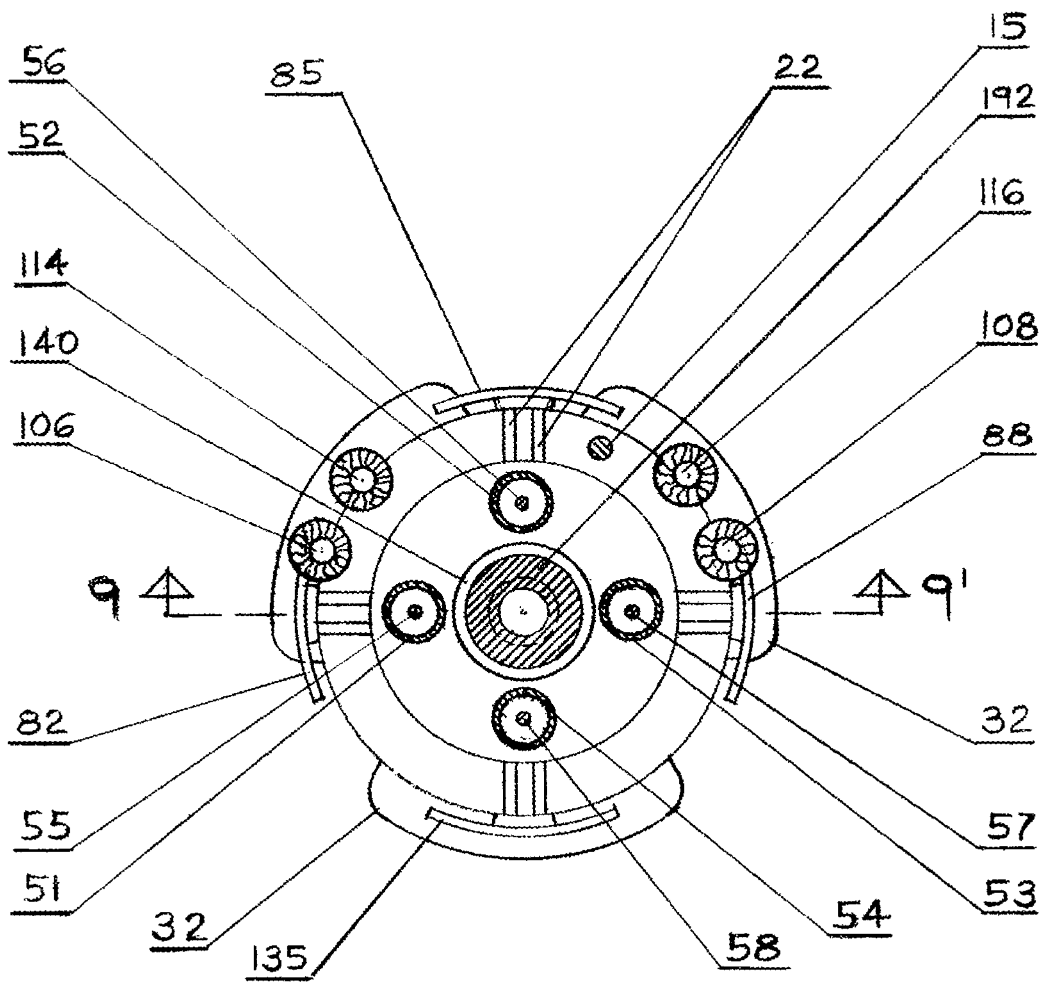
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FIG. 10

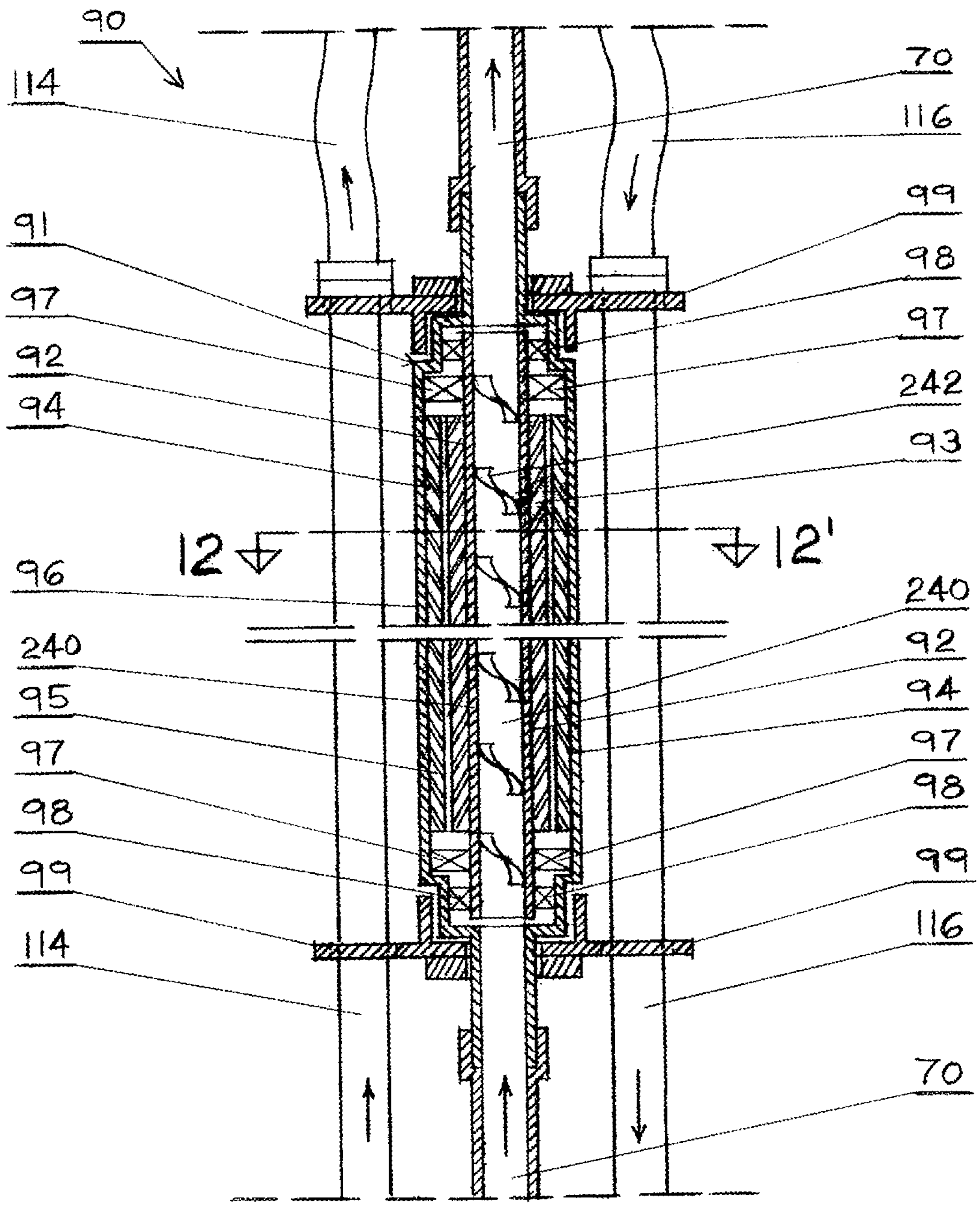
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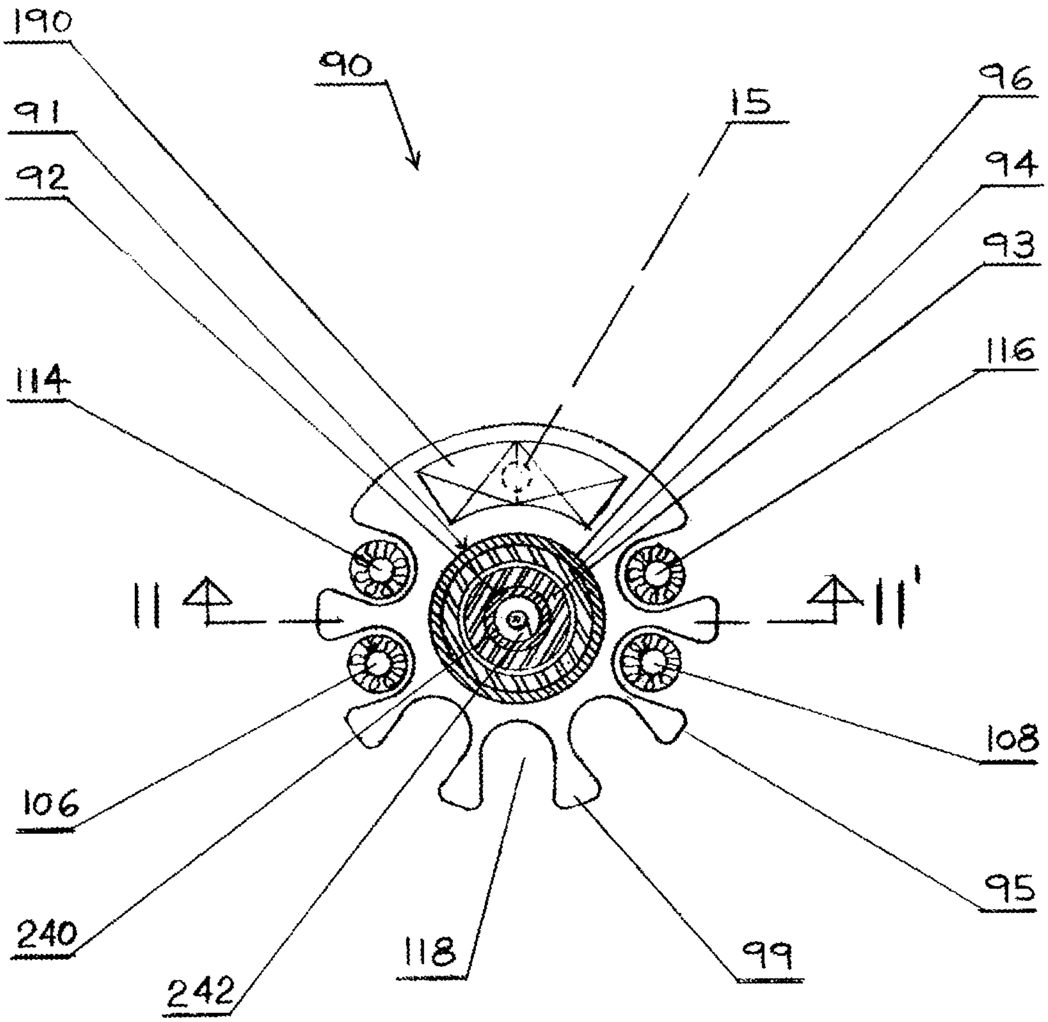
FIG. 11



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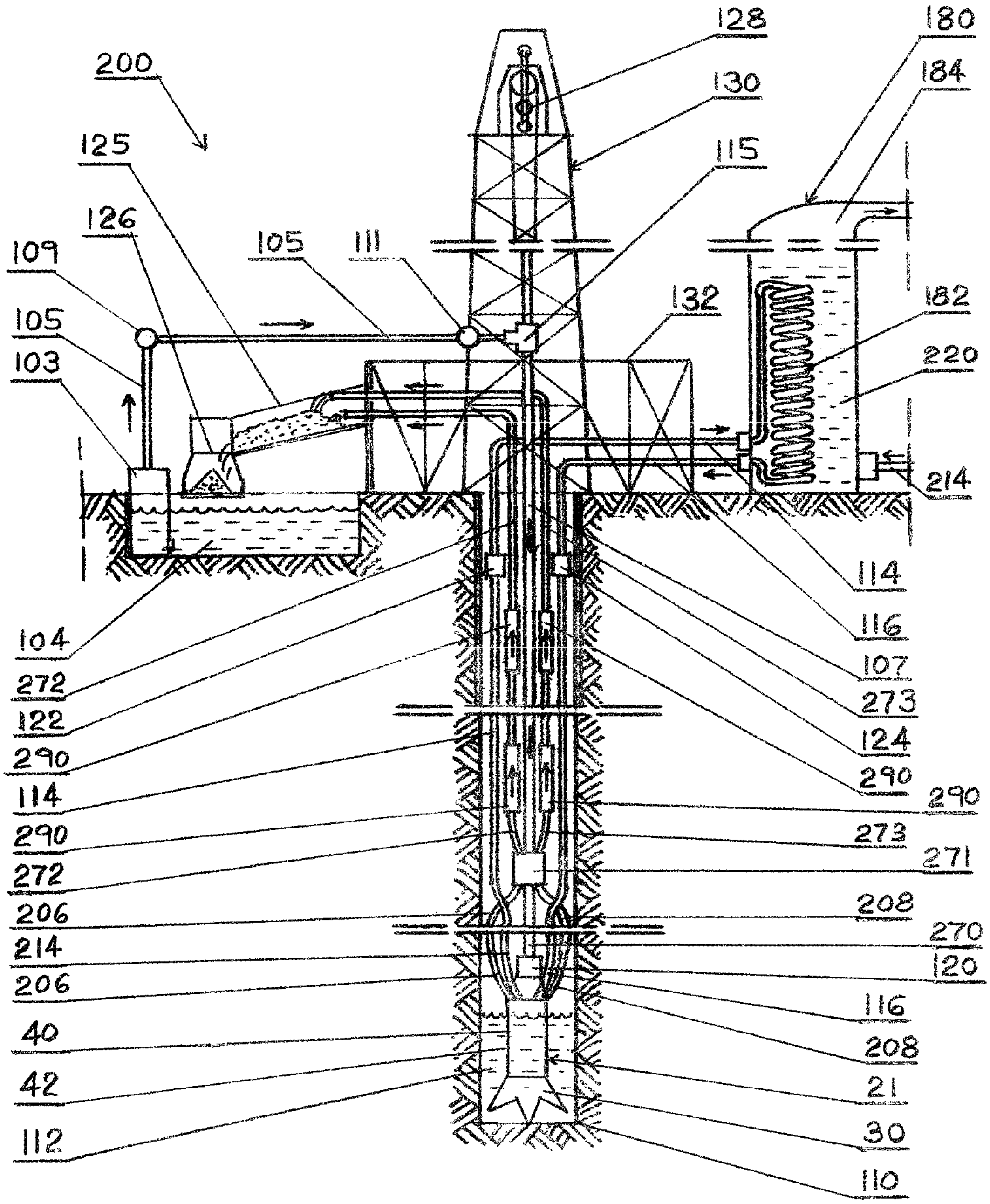
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FIG. 13

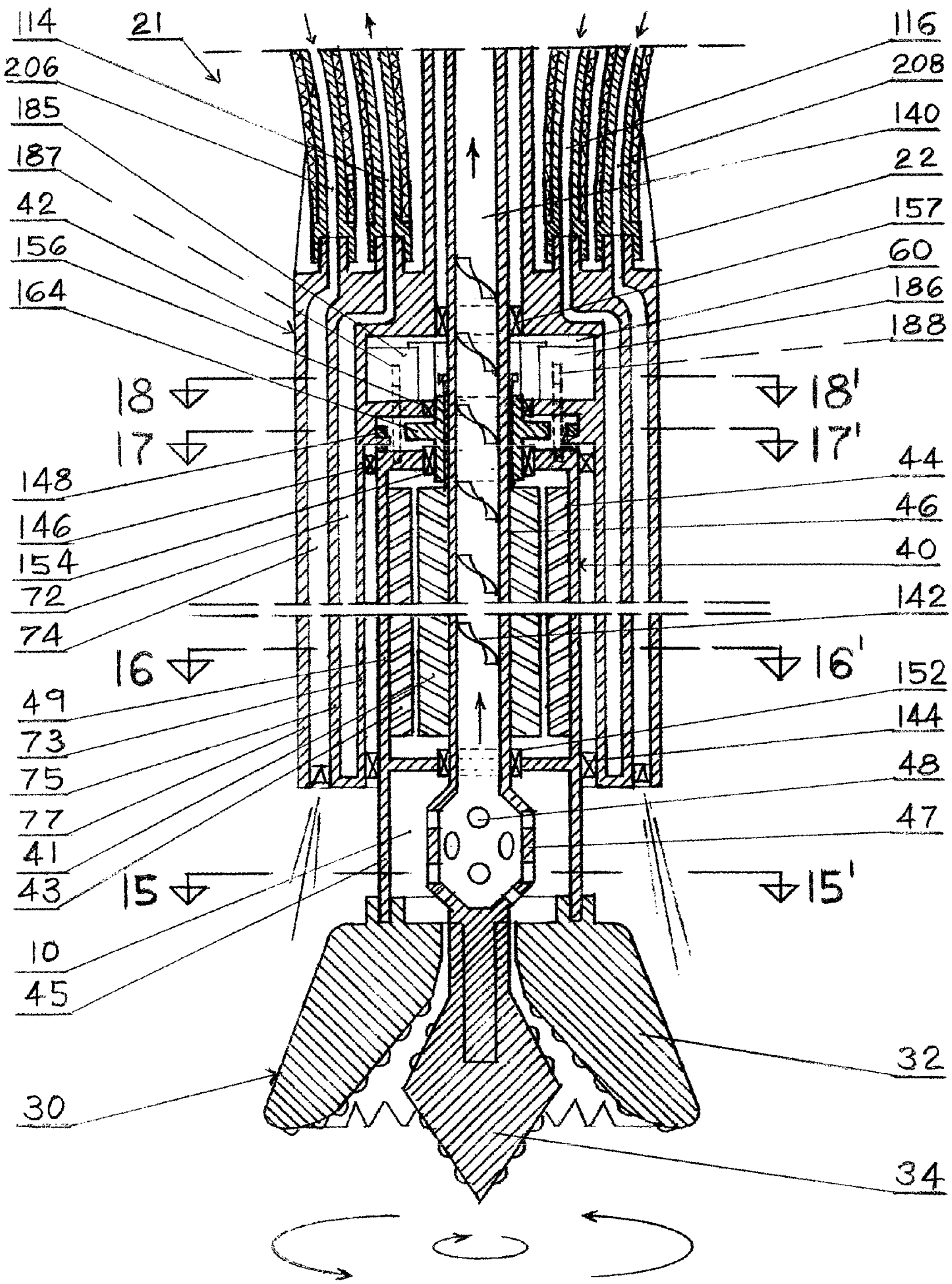
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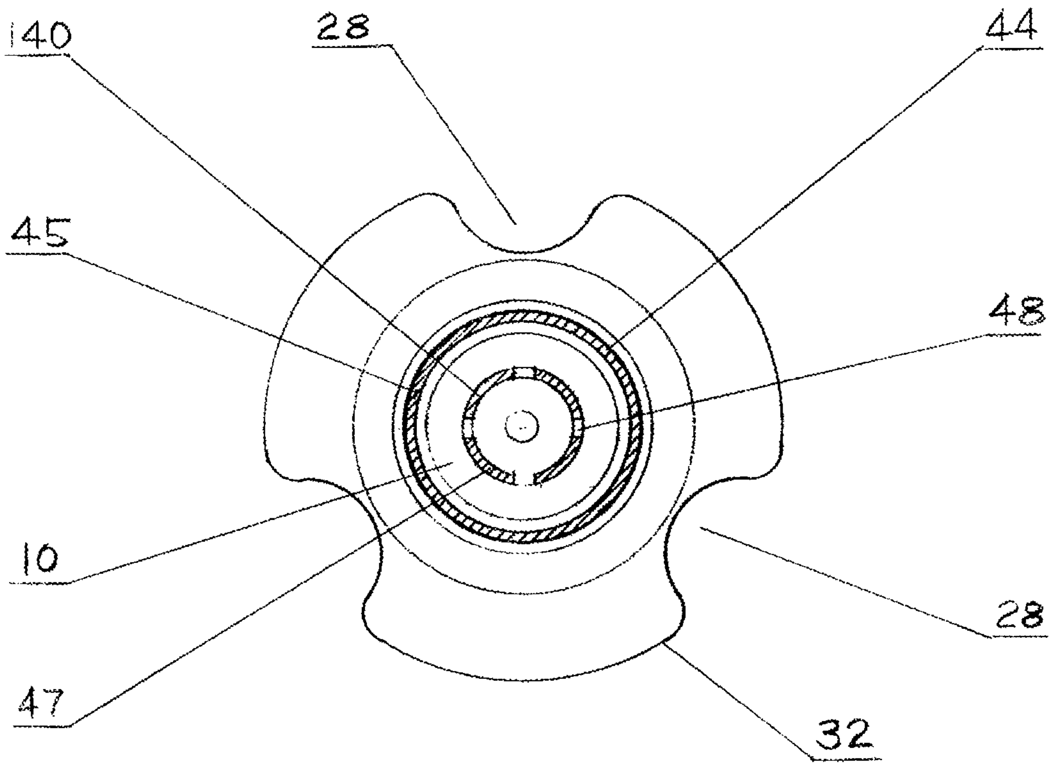
FIG. 14



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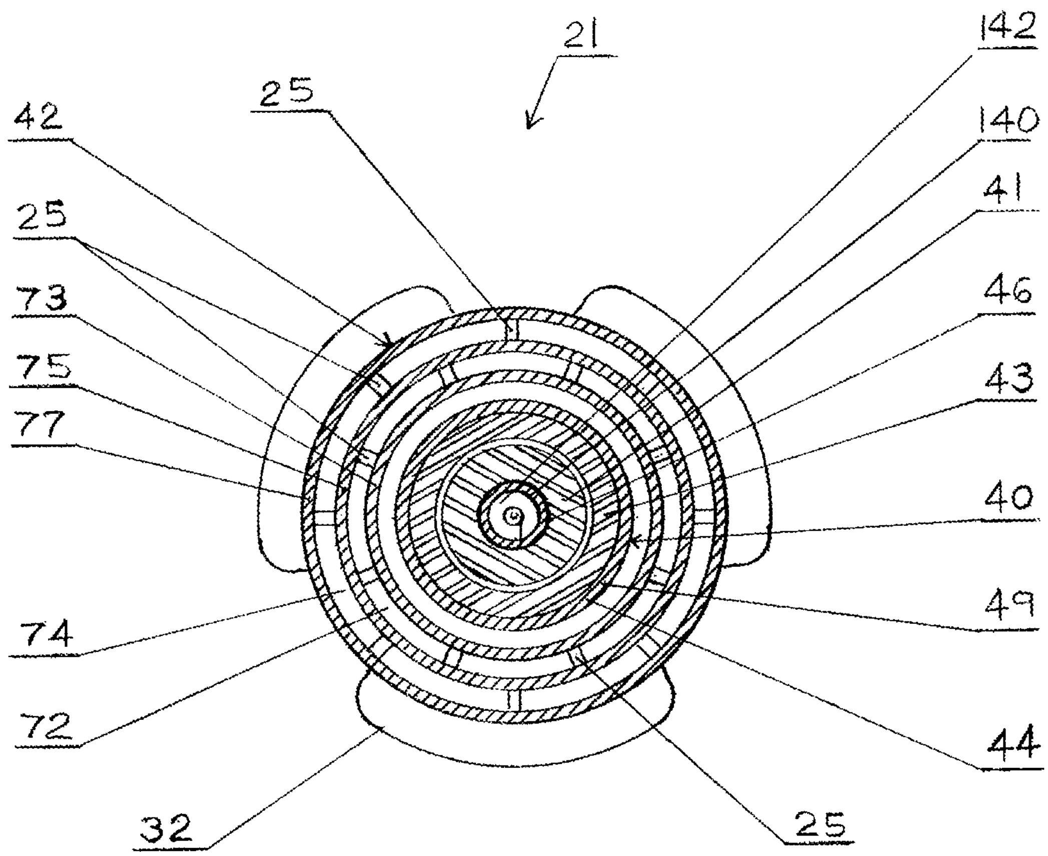

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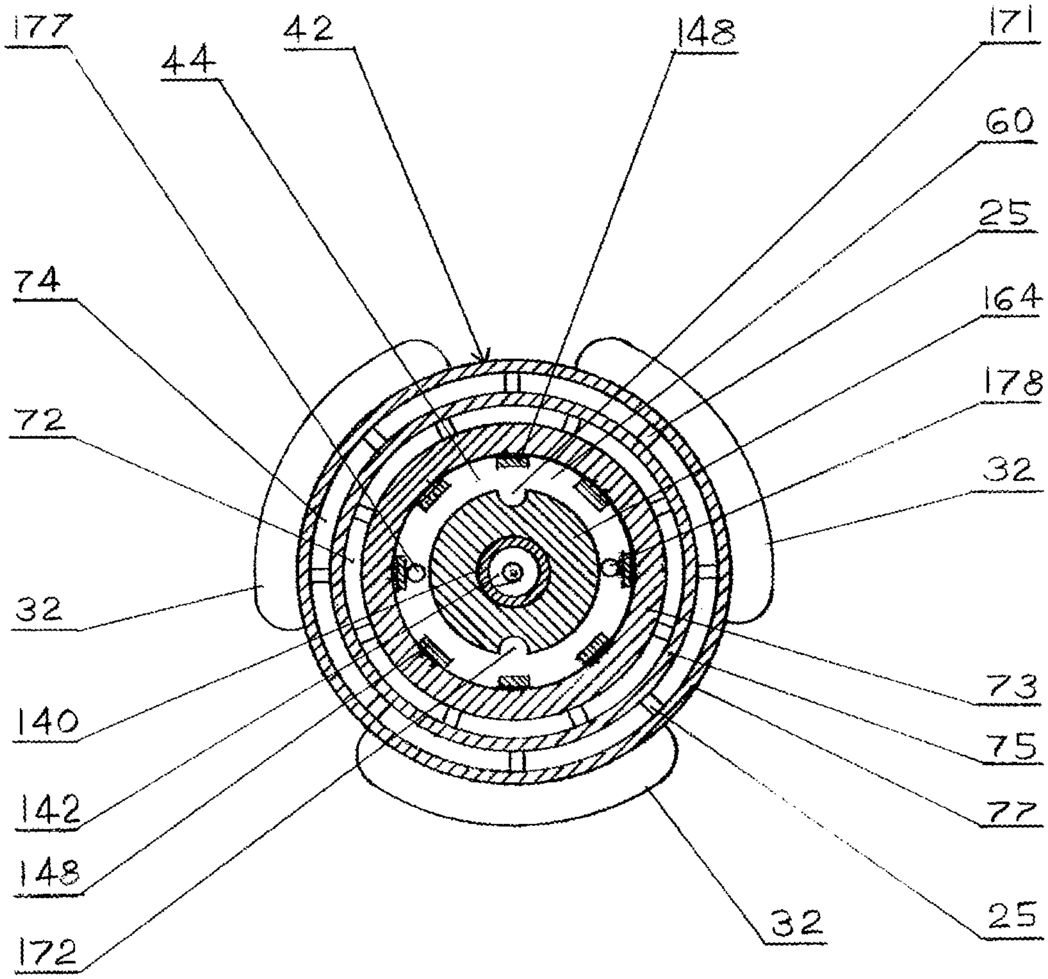
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FIG. 17

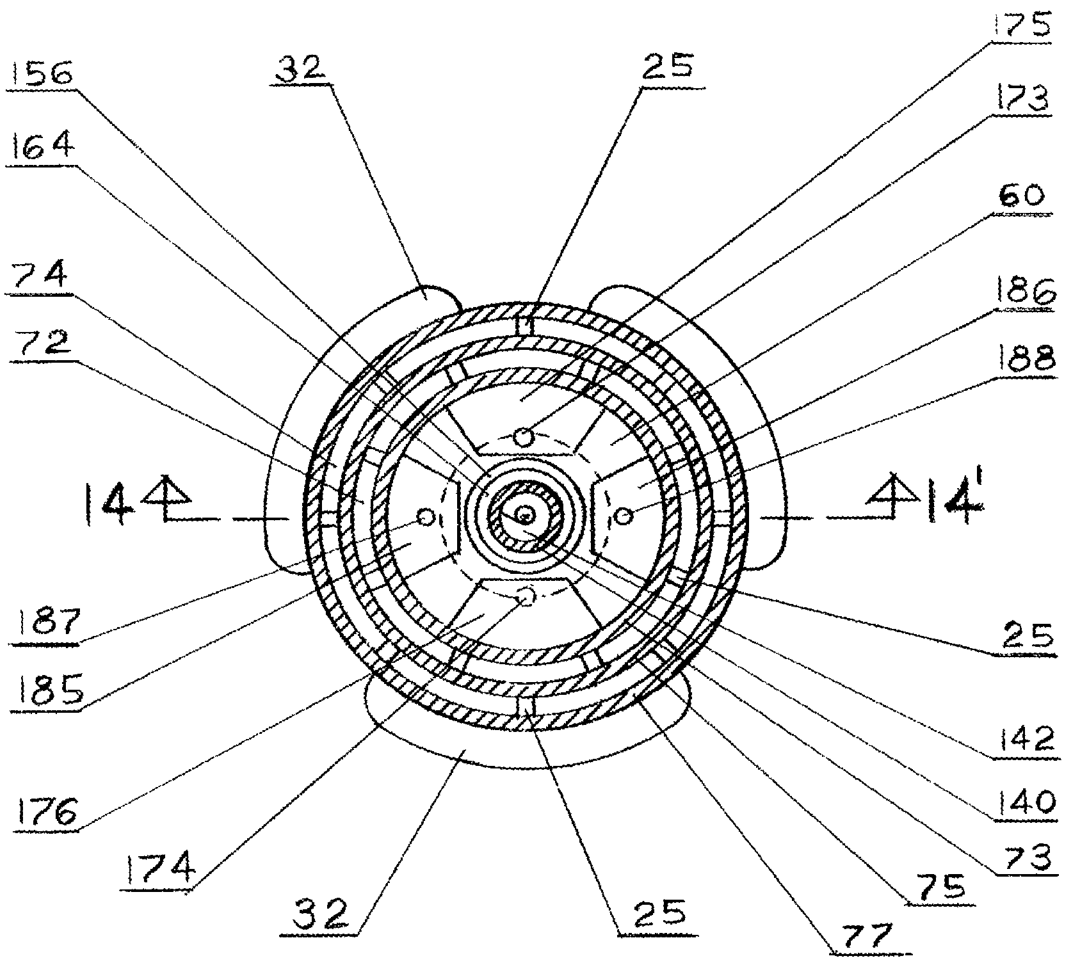
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FIG. 18

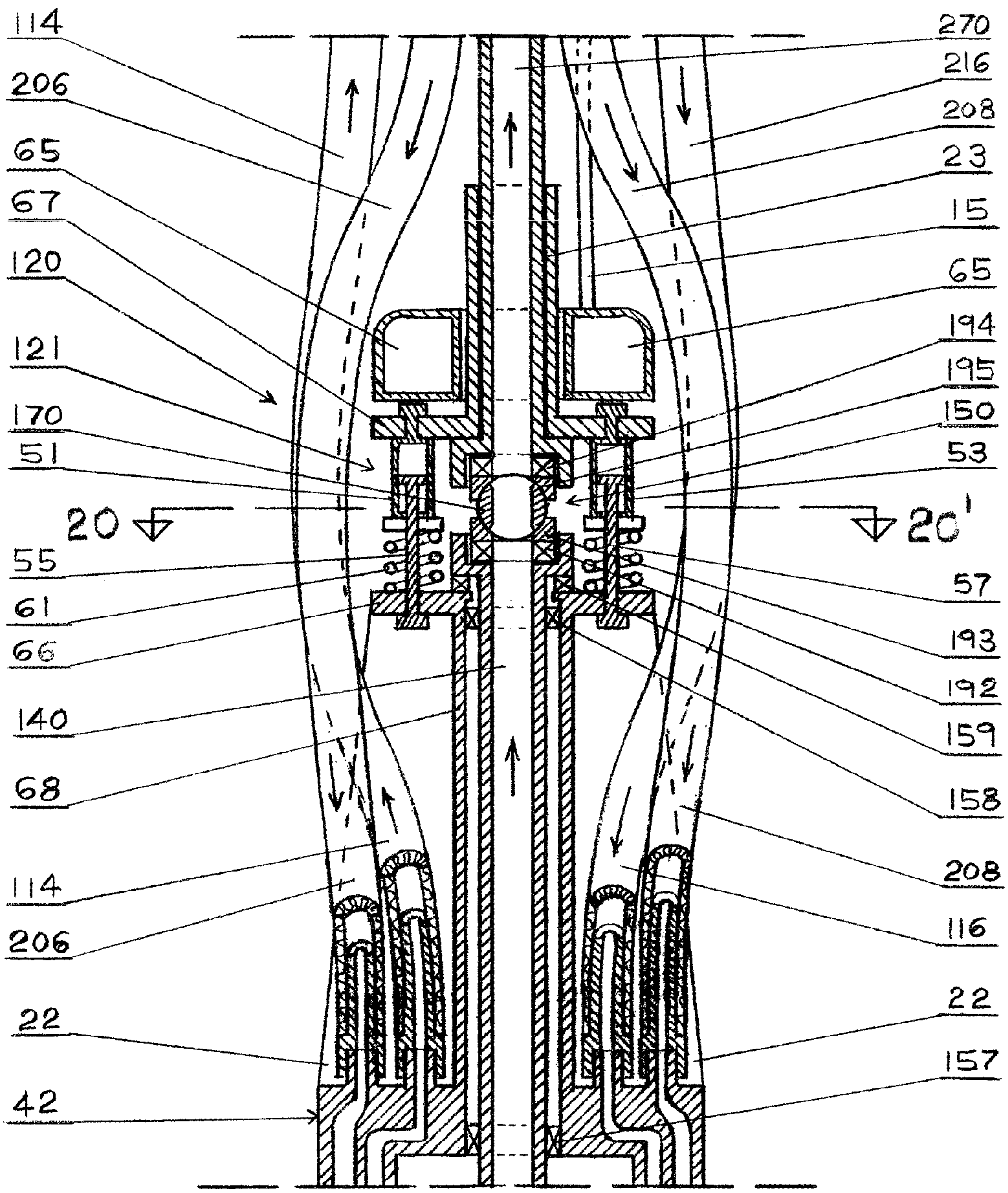
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FIG. 19

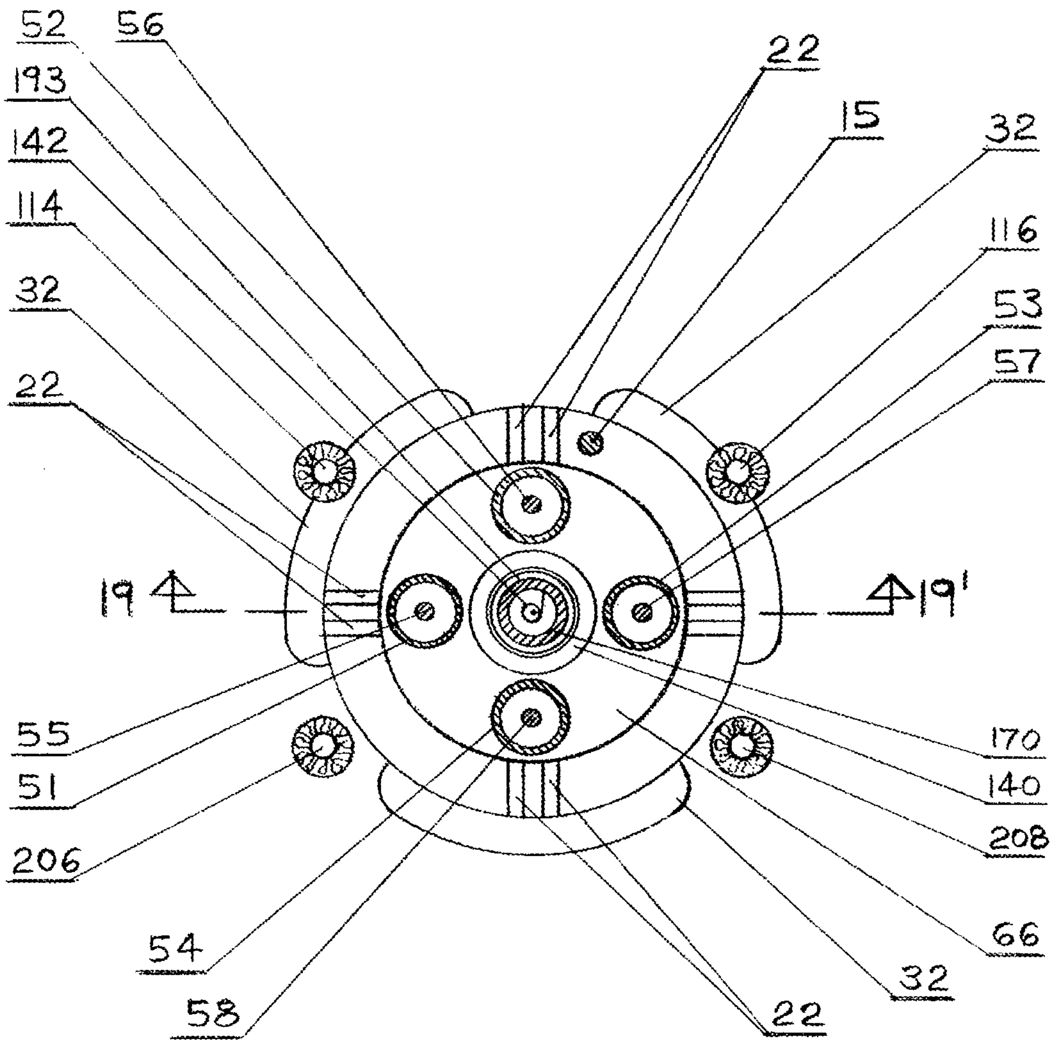
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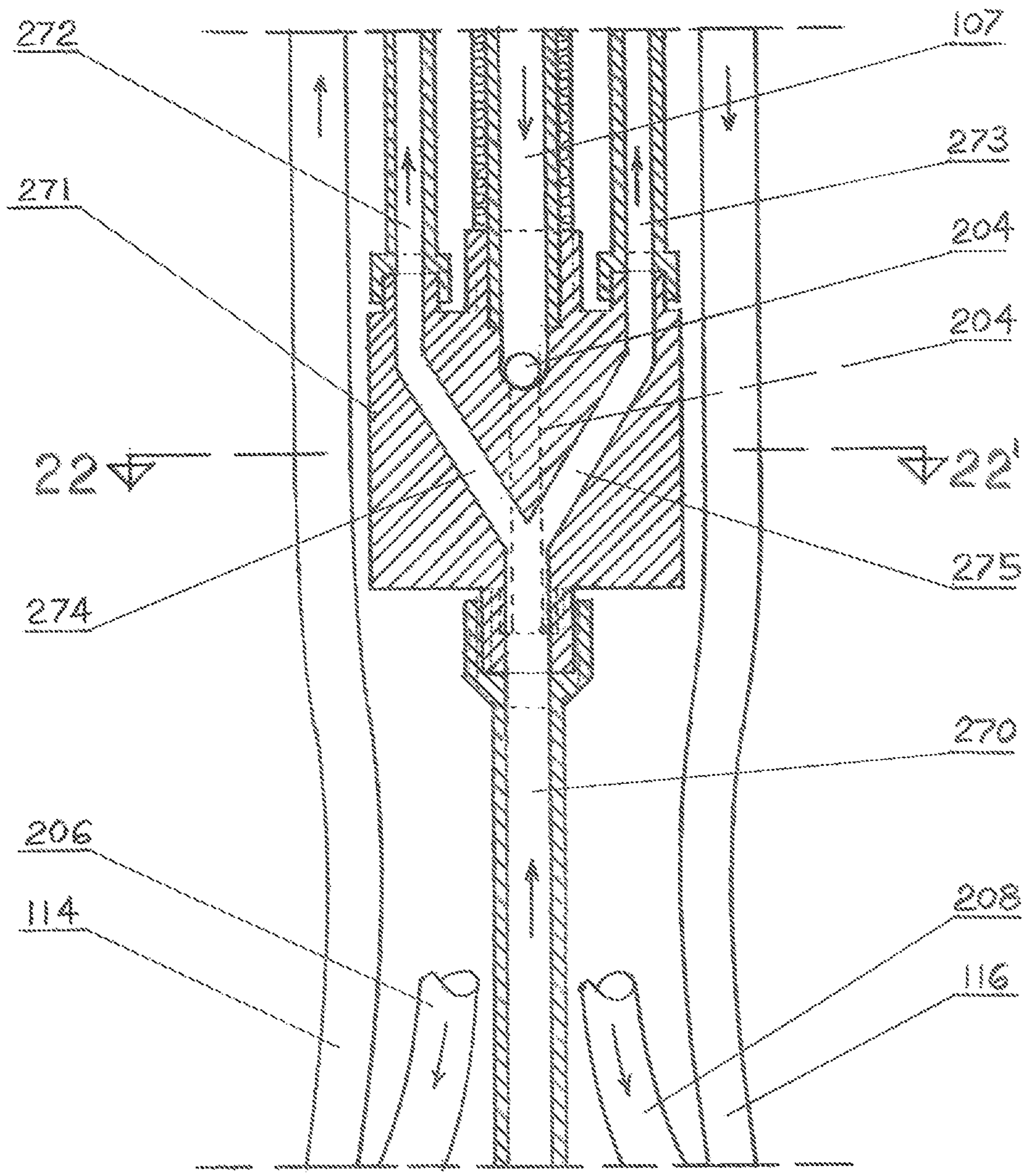
FIG. 20



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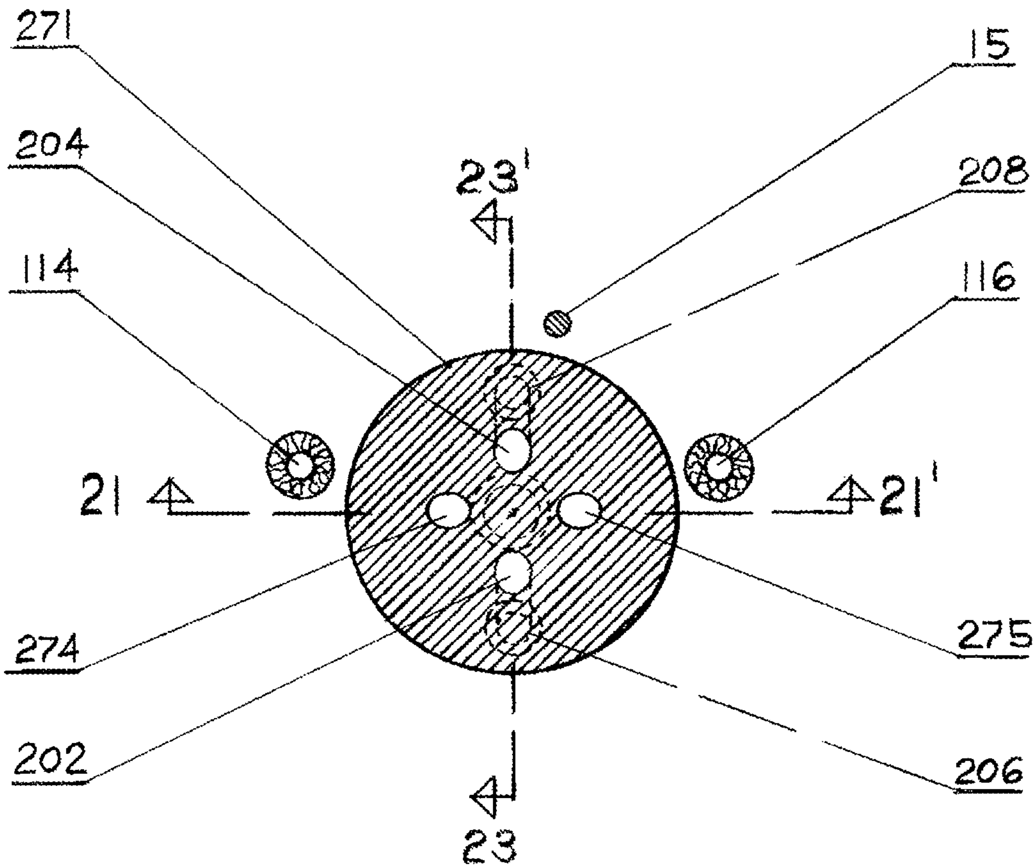
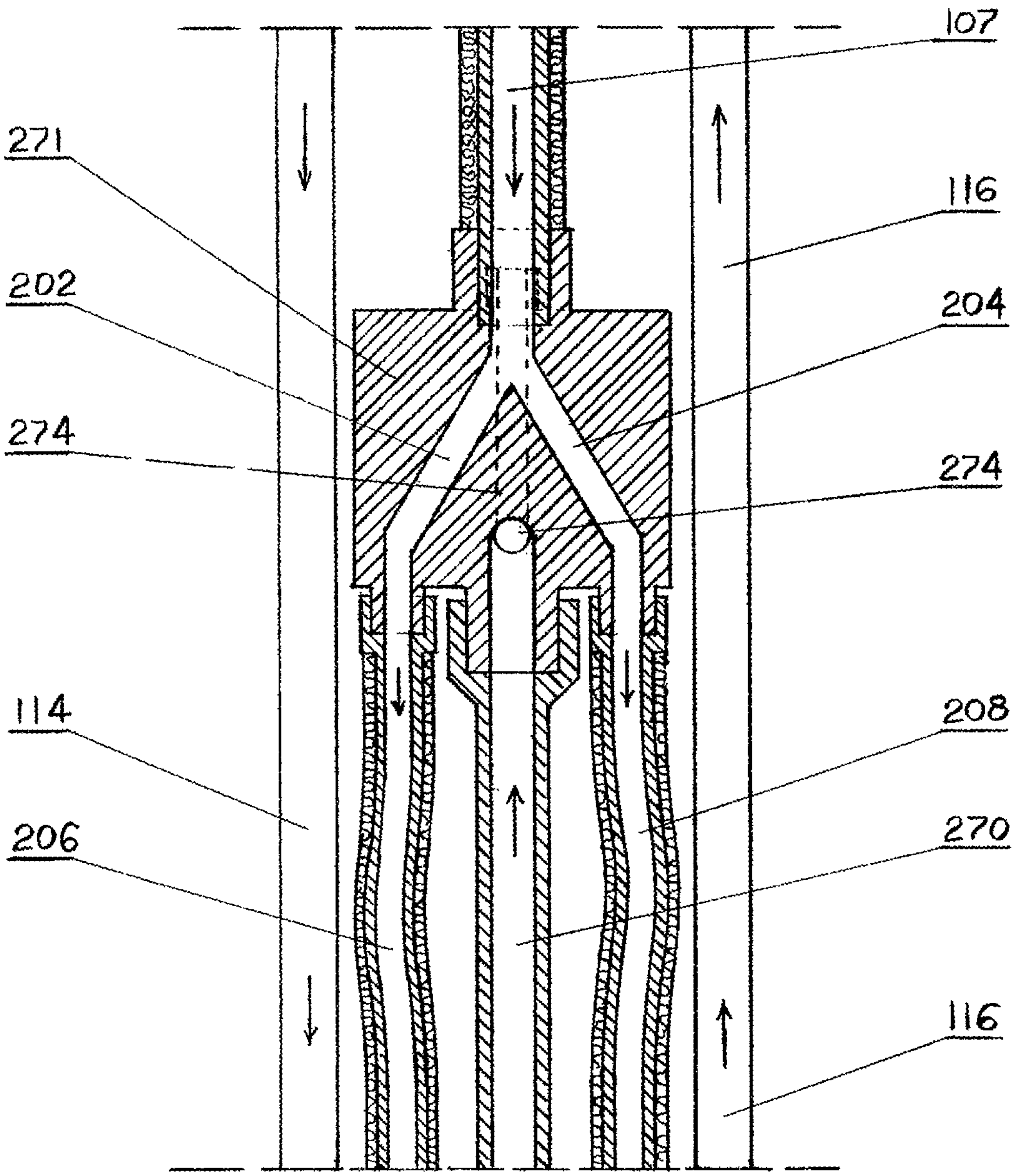


FIG. 22



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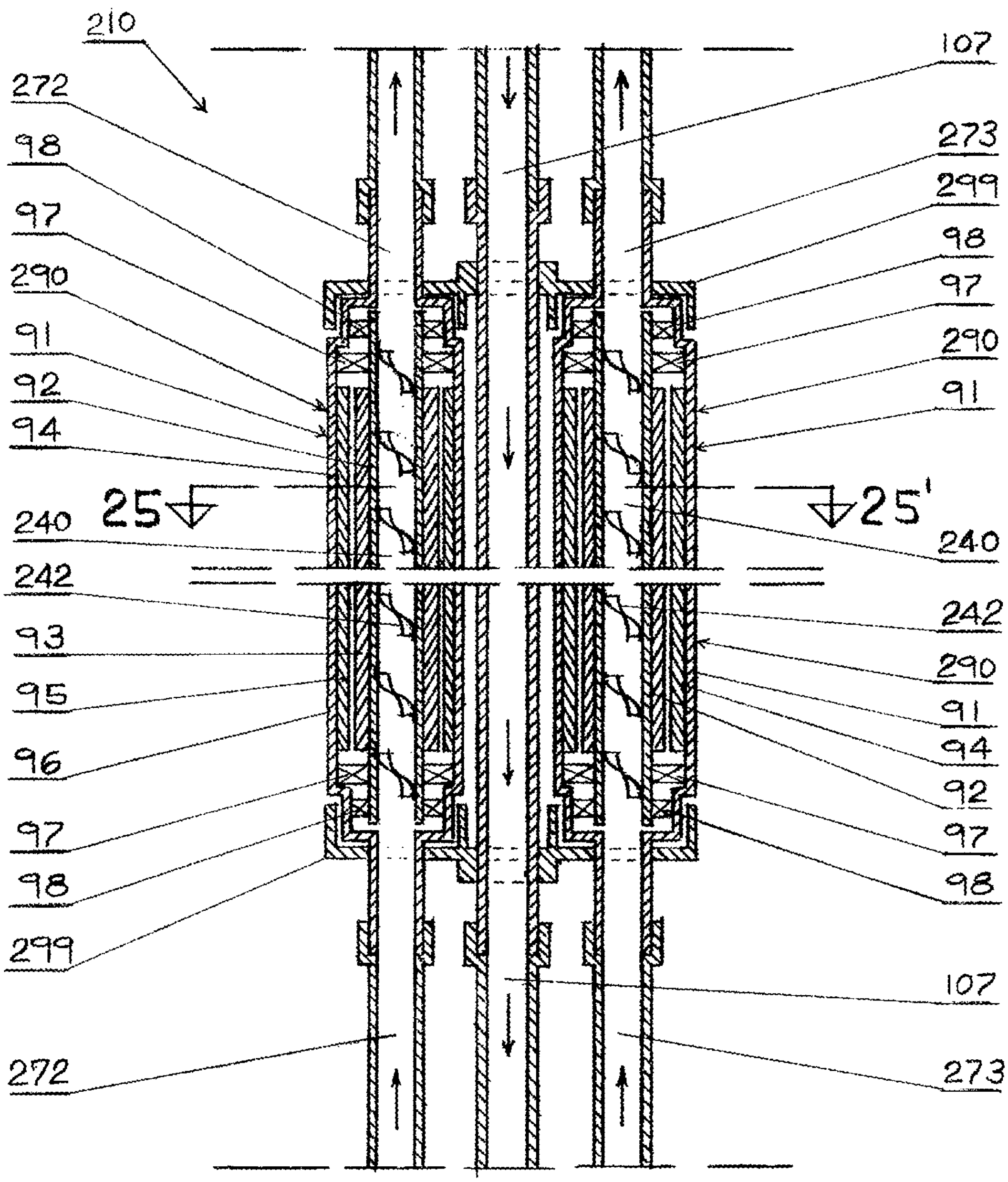
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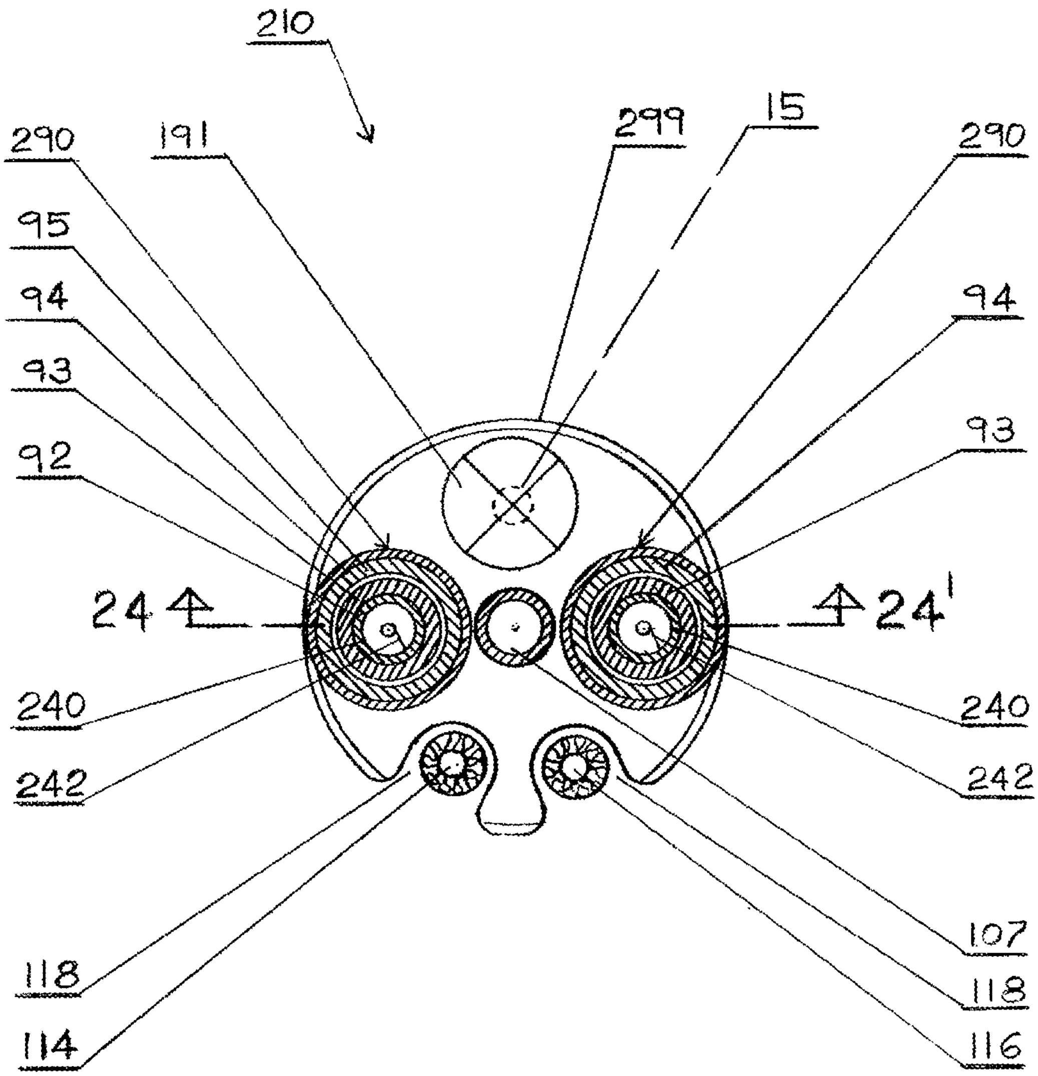
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FIG. 25

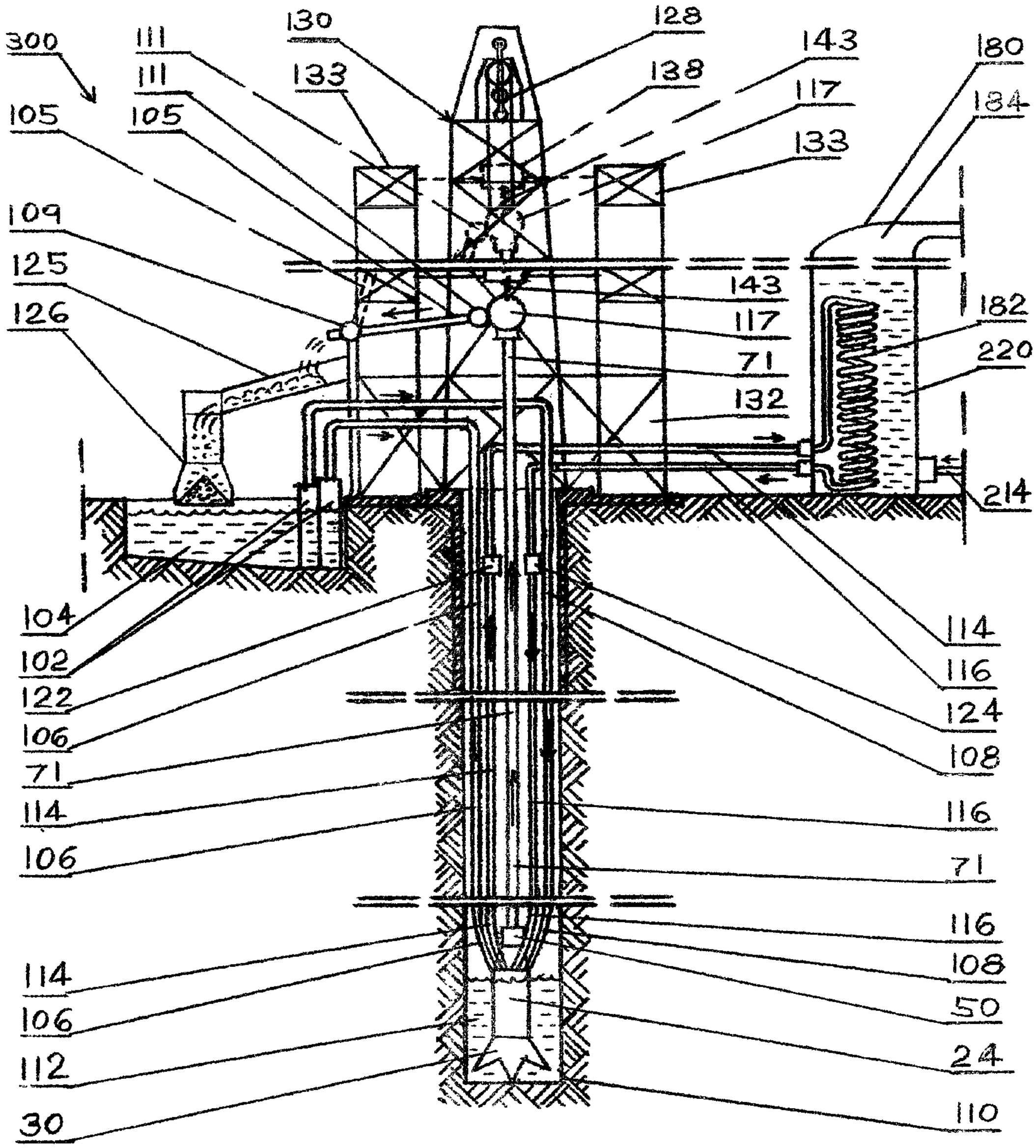
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FIG. 26

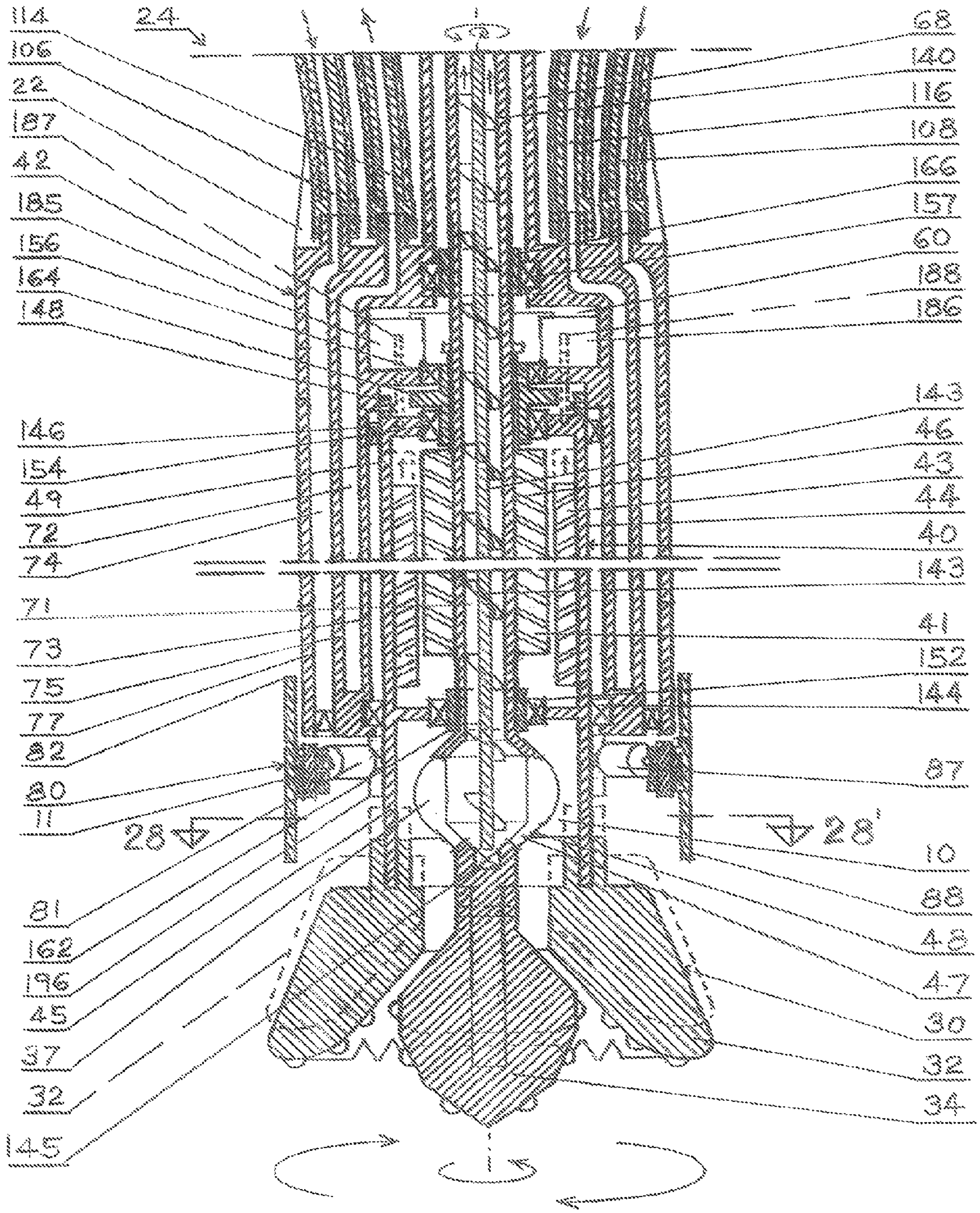
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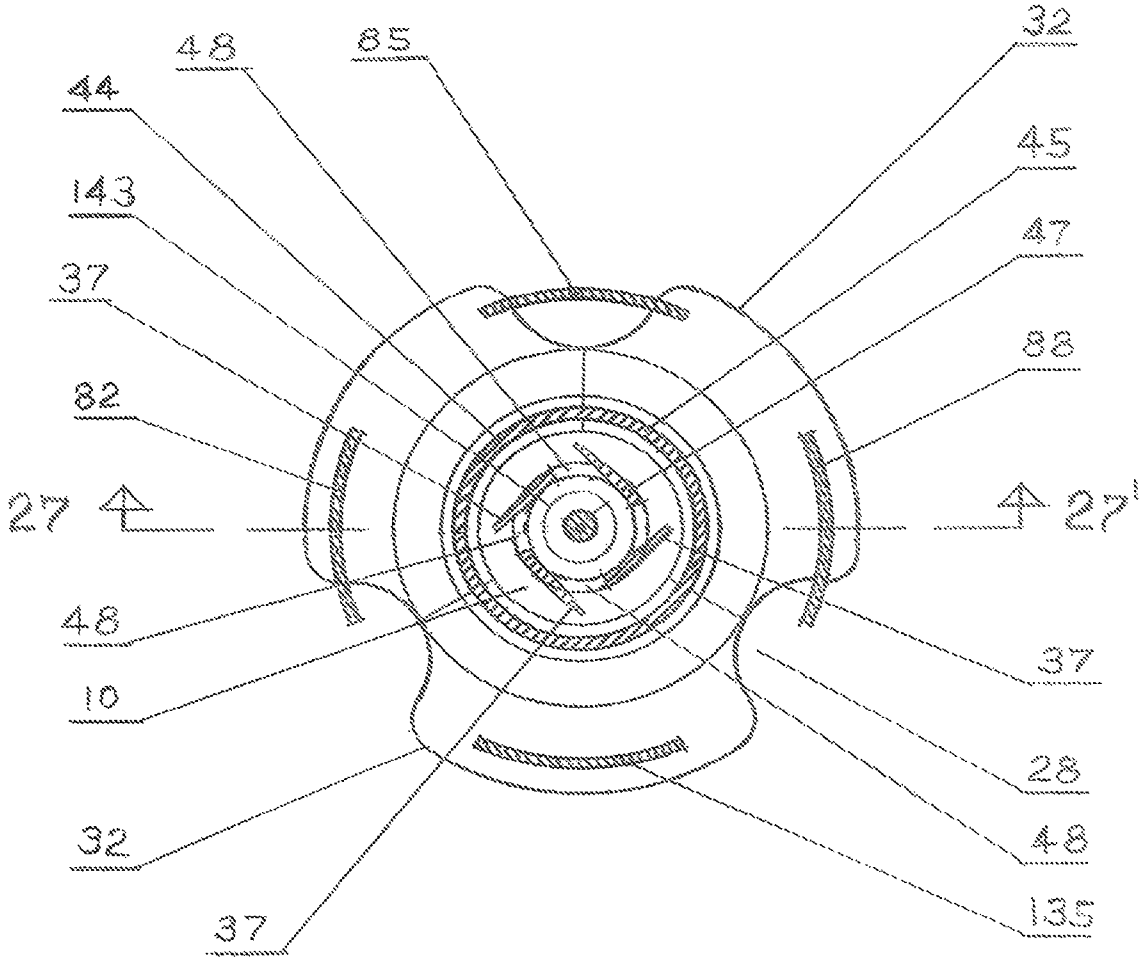
FIG. 27



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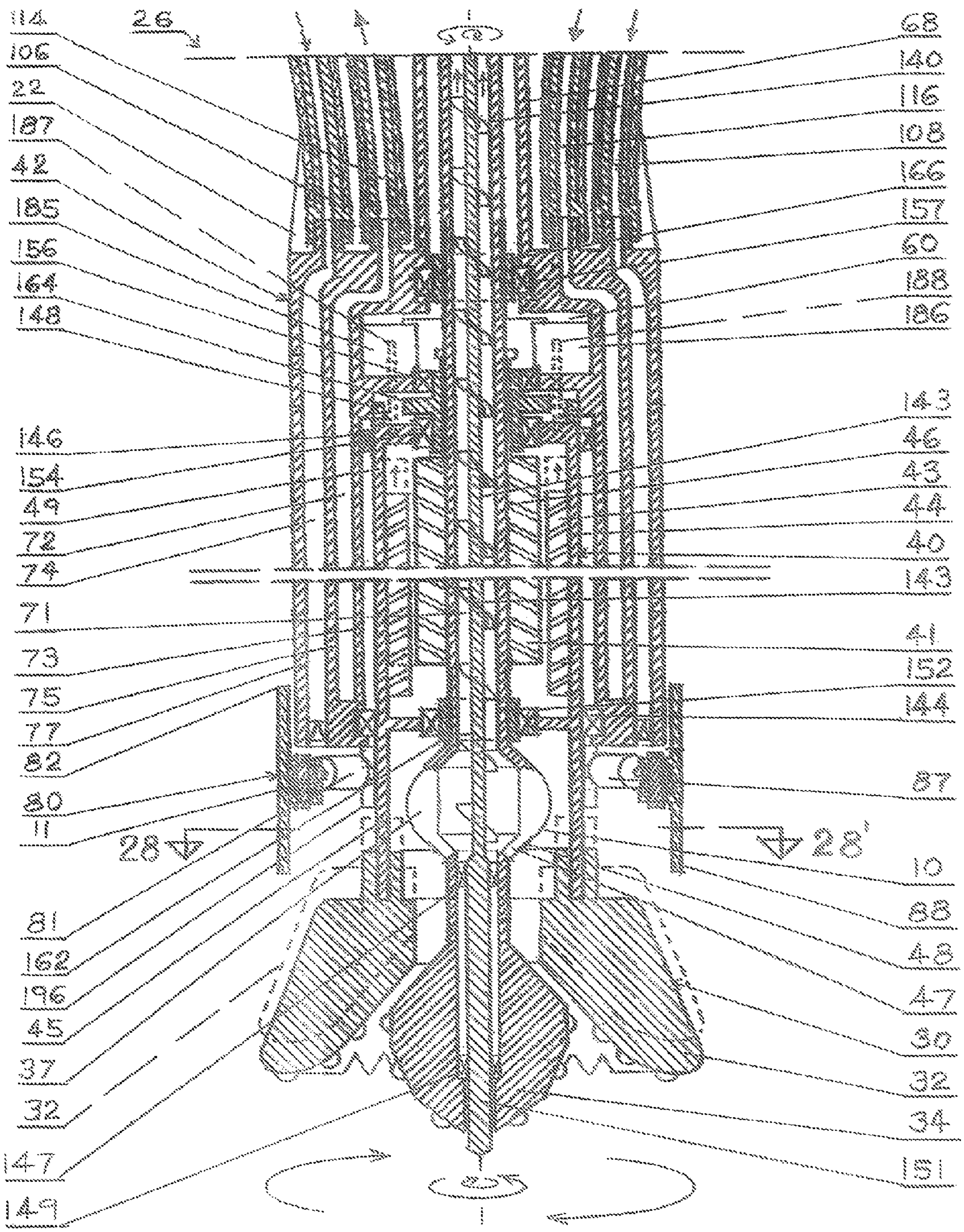
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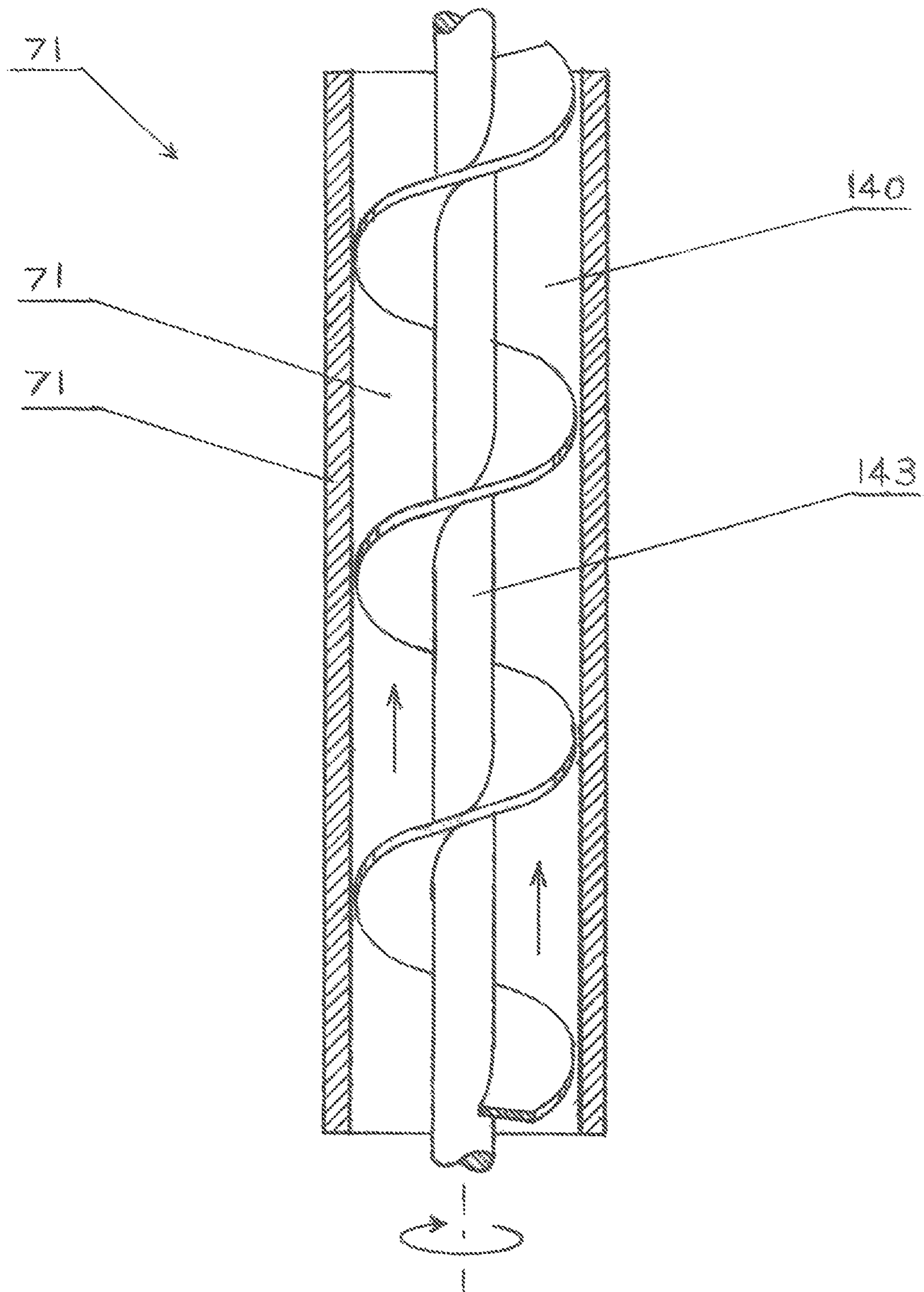
FIG. 29



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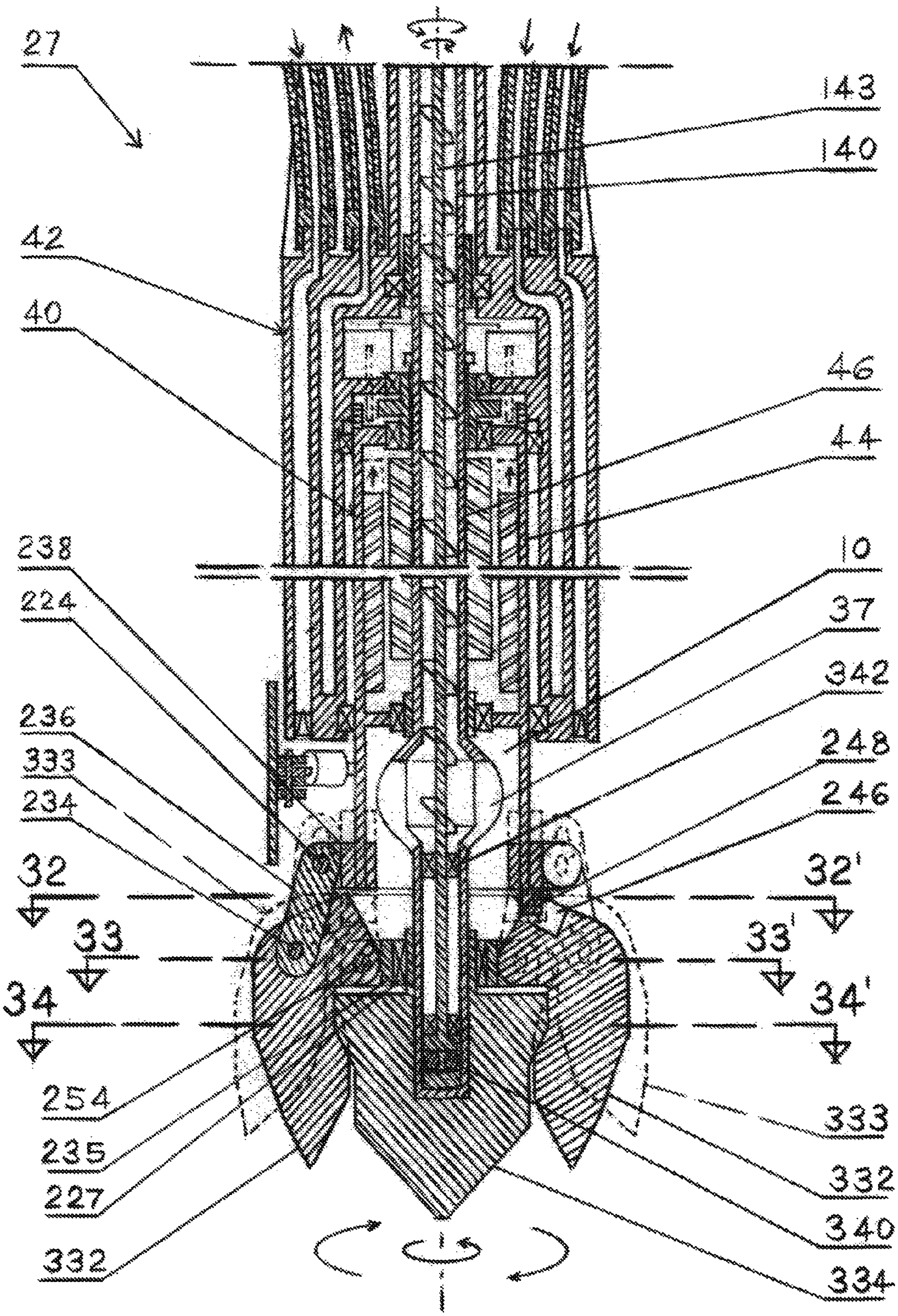
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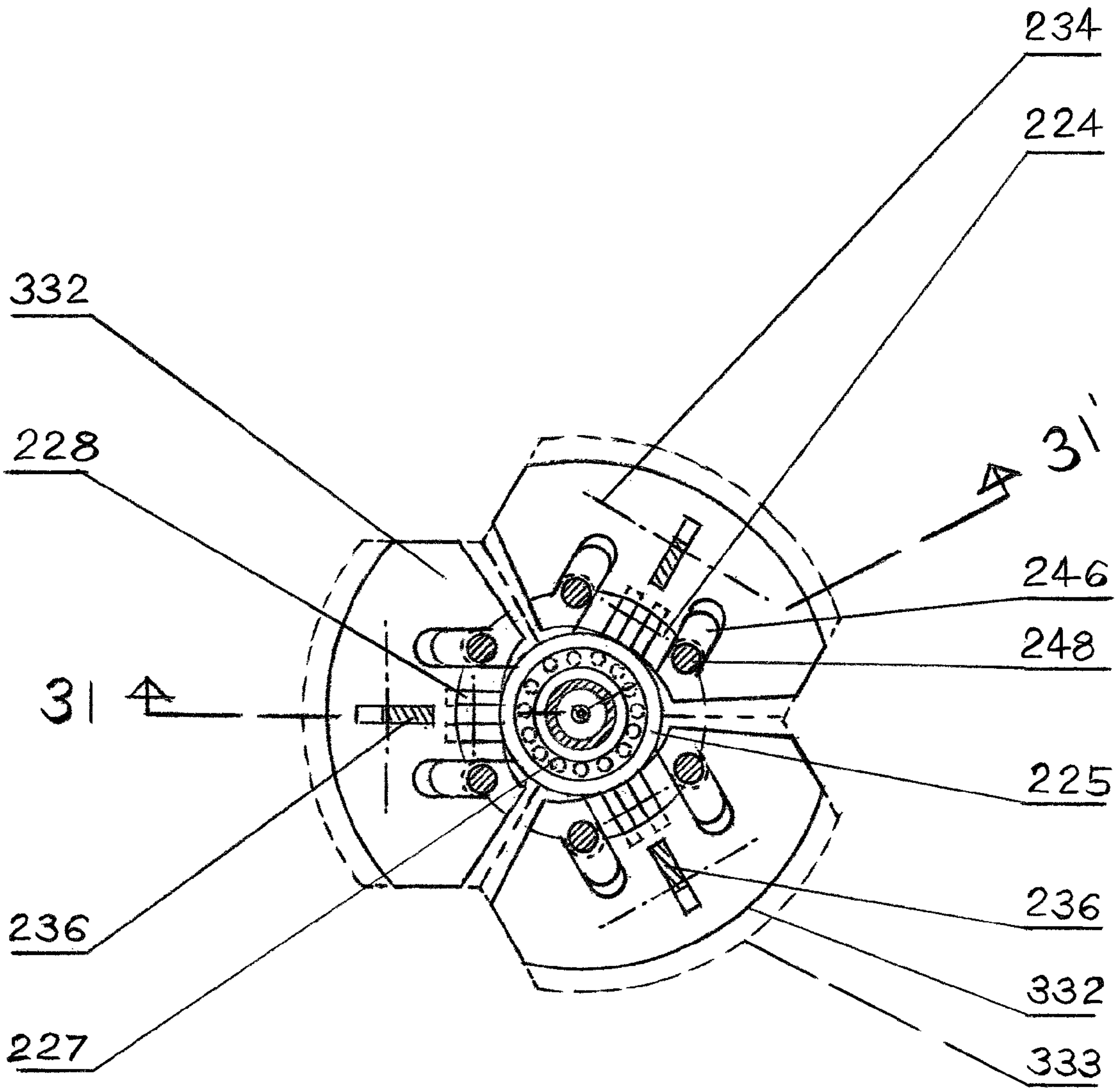
FIG. 31



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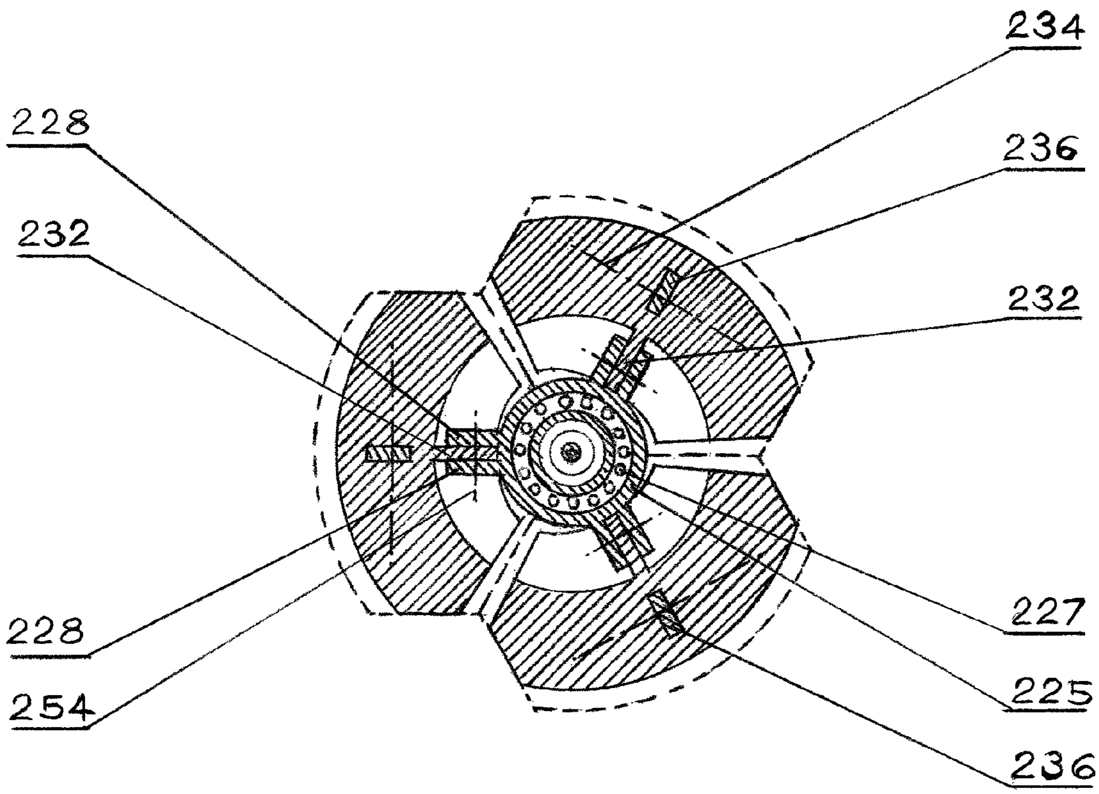

FIG. 33

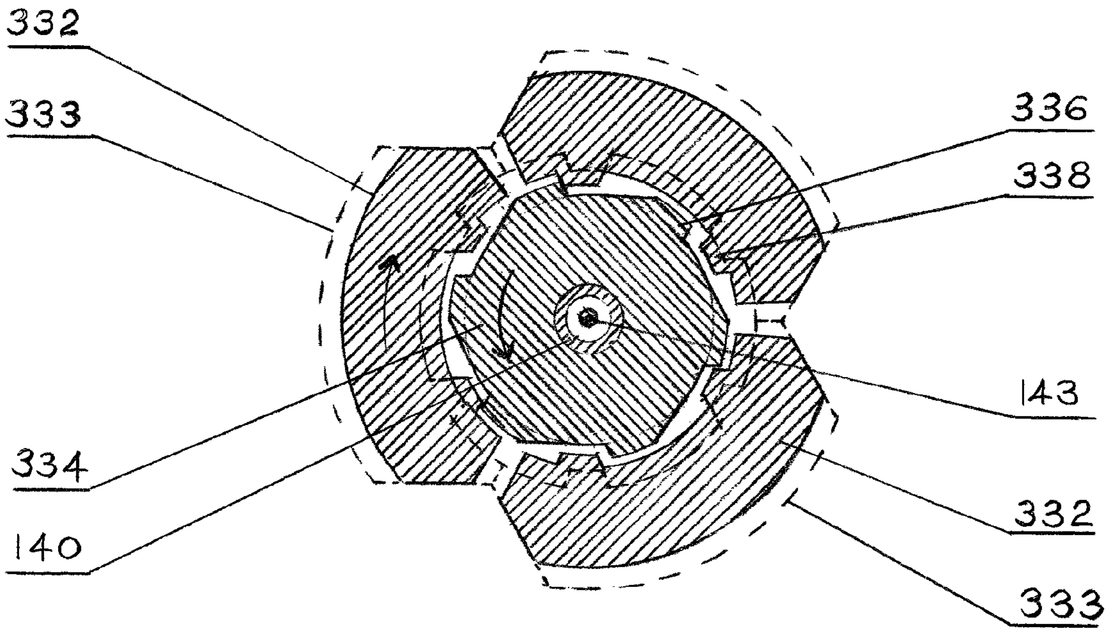

FIG. 34

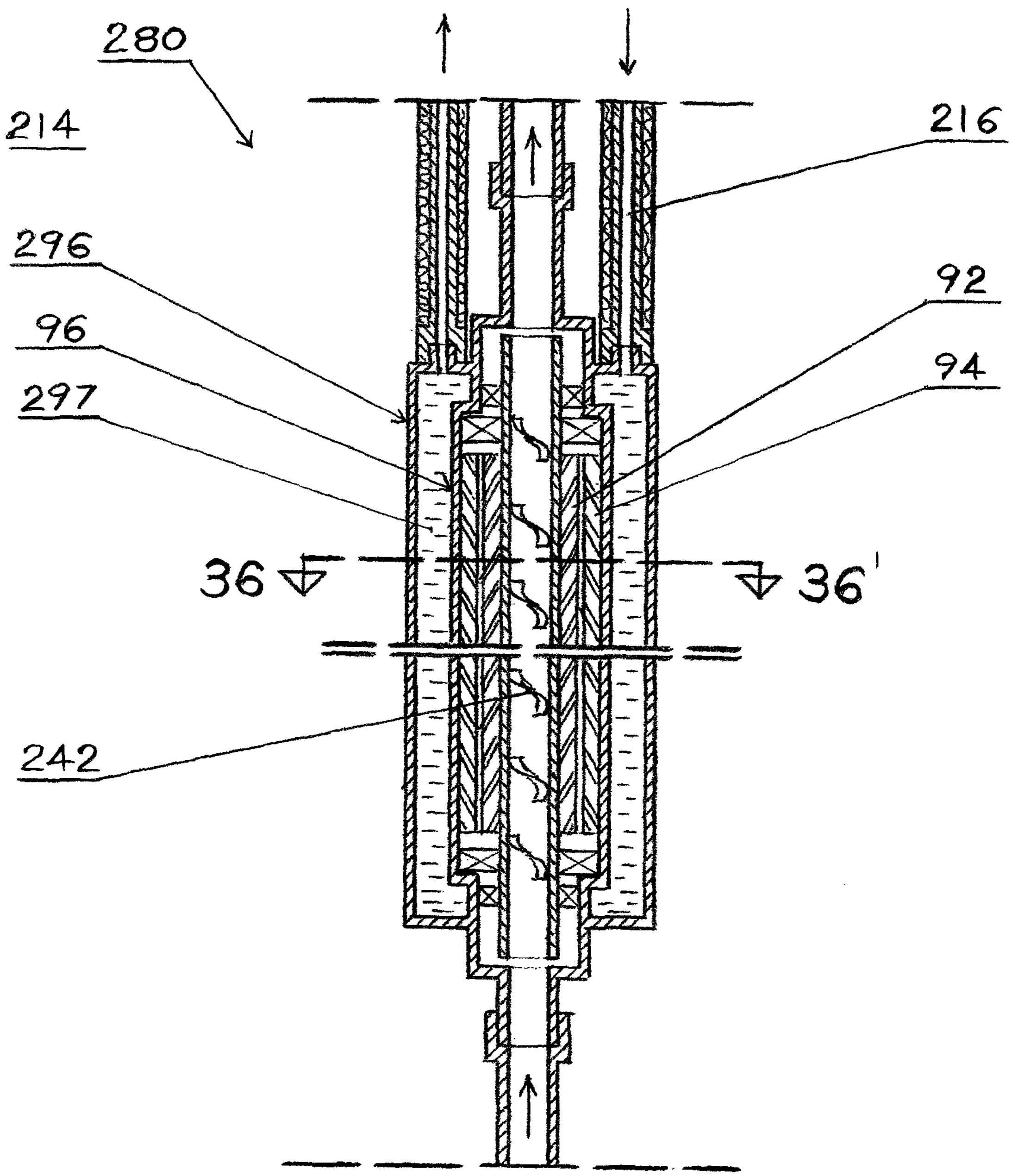

FIG. 35

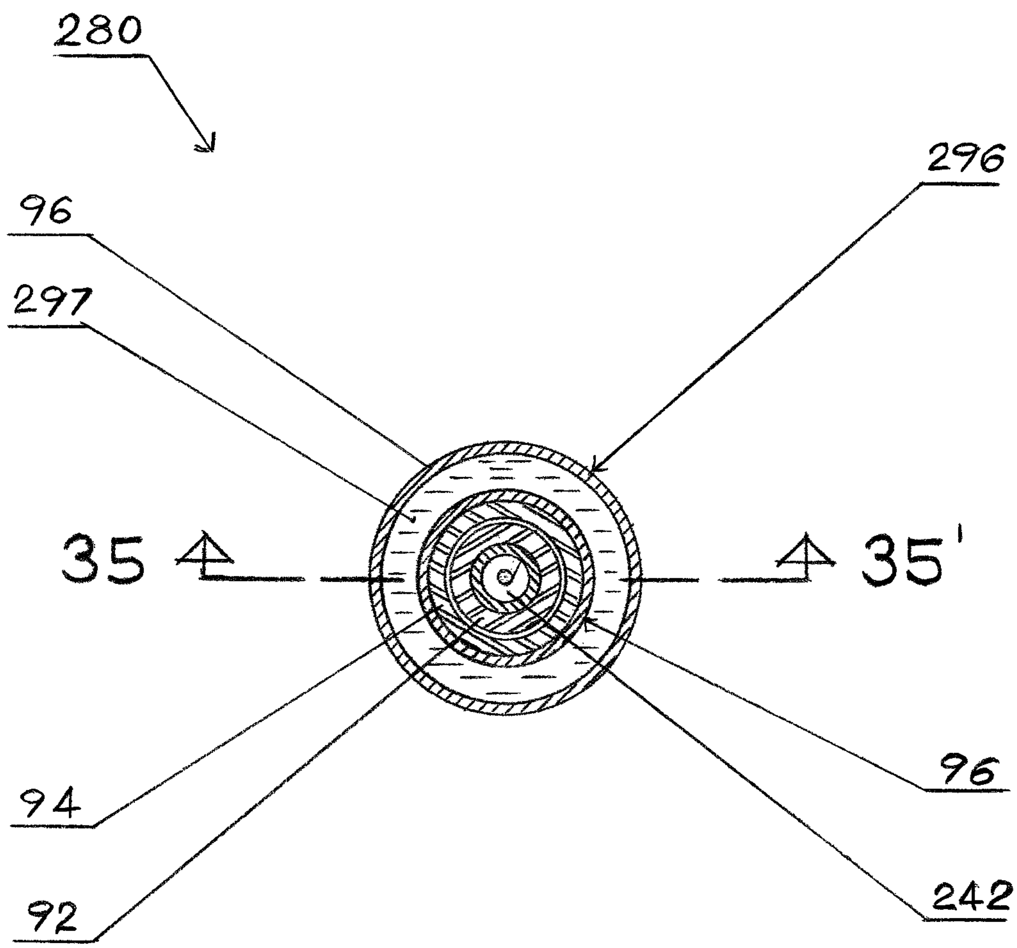

FIG. 36

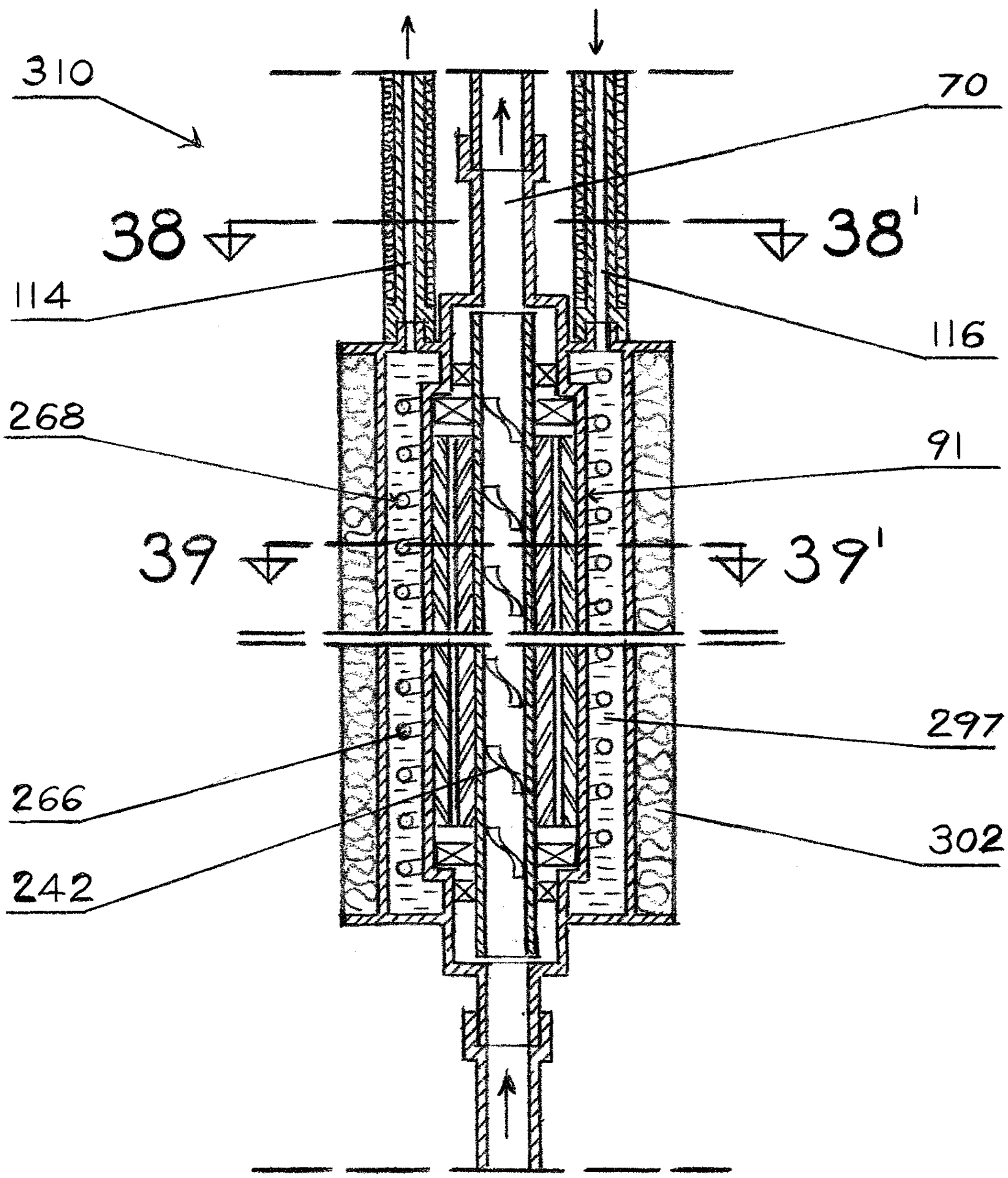

FIG. 37

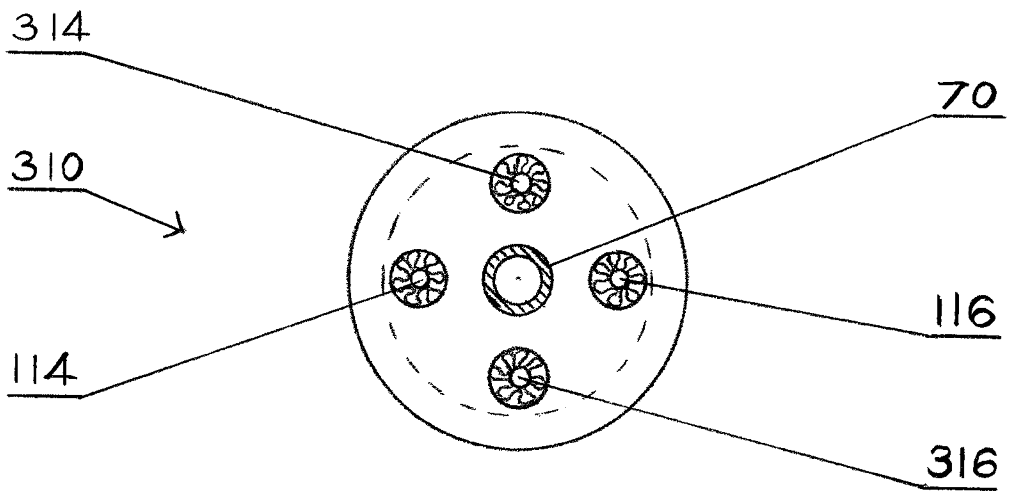

FIG. 38

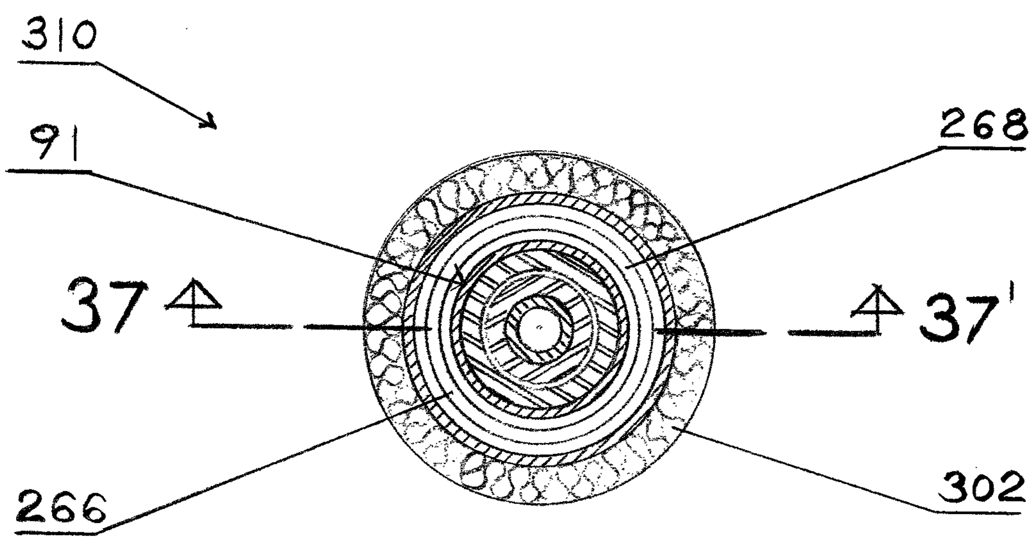

FIG. 39

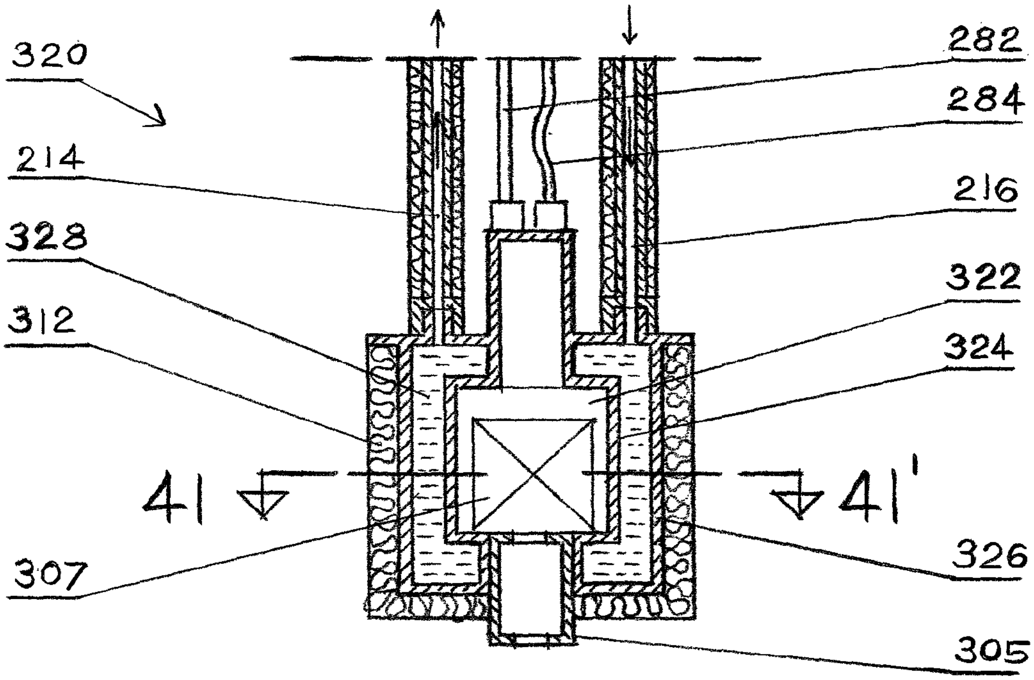
320
282
284
214
216
328
322
312
324
41
41'
307
326
305

FIG. 40

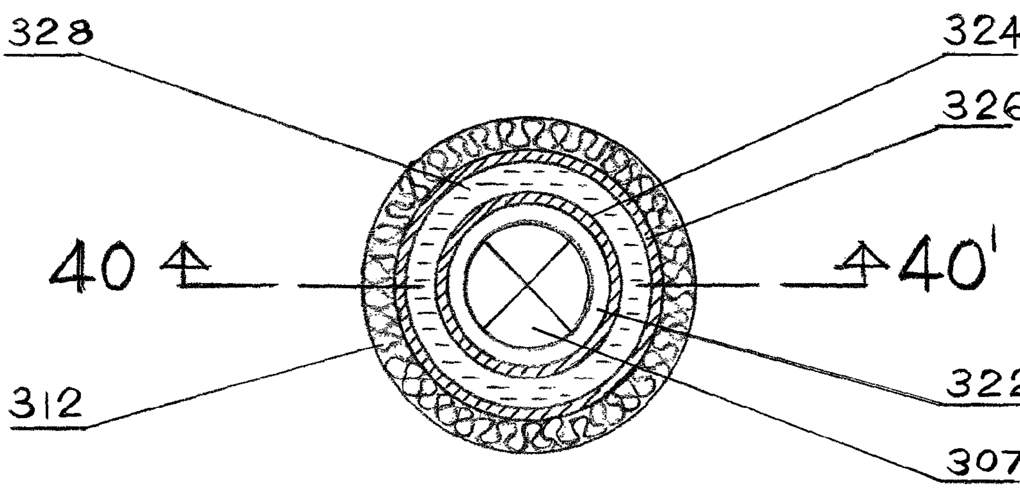
328
324
326
40
40'
312
322
307

FIG. 41

APPARATUS FOR DRILLING FASTER, DEEPER AND WIDER WELL BORE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of PCT Application No. PCT/US2010/049532, filed Sep. 20, 2010, still pending, which claims priority to U.S. Provisional Application No. 61/276,967 filed Sep. 19, 2009, U.S. Provisional Application No. 61/395,235 filed May 10, 2010 and U.S. Provisional Application No. 61/397,109 filed Jun. 7, 2010 the contents of which are hereby incorporated entirely herein by reference.

BACKGROUND

1. Field of Invention

The subject matter described herein generally relates to a drilling apparatus and related method, and more specifically to well bore drilling for an emerging technology such as "Self Contained In-Ground Geothermal Generators" (SCI-GGG) where drilling relatively deeper wells having a wider diameter and reduced drilling cost are applicable.

2. Related Art

Nearly all oil, gas, and geothermal wells are drilled using a rotating system. In rotary drilling, a steel tower supports a length of hollow heat treated alloy steel drill pipe having a drill bit positioned at one end. The drill pipe is rotated by a rotary table to cut a hole in the earth called a well bore. The well bore may have a diameter of 20 inches (51 cm) or more, but is typically less.

Four major systems generally comprise an operational rotary drilling (rig) system: a power supply, a hoisting system, a rotating system (mentioned above), and a circulating system. A drill system requires the power supply in order for the other rig systems to operate. Power may be supplied through one or more diesel engines used alone or in combination with an electrical power supply.

The hoisting system raises, lowers, and suspends equipment in the well bore and typically includes a drill or hoist line composed of wound steel cable spooled over a revolving reel. The cable passes through a number of pulleys, including one suspended from the top of the tower. The hoisting system is used to move drill pipe into or out of the well bore. As the depth of the well bore increases additional sections of drill pipe are added to the opposite end of the drill pipe to form a drill string.

During drilling, the circulating system pumps drilling mud or fluid down through the hollow drill pipe into the well bore. A liquid, oil, or synthetic based mud is typically used during the drilling process. The mud and cutting exit the pipe through holes or nozzles in the drill bit and return to the surface through the space between the drill pipe and the well bore wall.

The mud and cuttings separated and the mud is re-circulated into the well bore. Drilling mud cools the drill bit, stabilizes the well bore walls, and controls the formation fluid that may flow into the well bore.

Alternatively, an air drilling system may be employed to remove drill cuttings. The air drilling rig and operations are identical to those for the rotary drilling rig, except there is no circulating system. Instead of mud, air is pumped down the drill string and out the drill bit, forcing the cuttings up and out of the well bore.

Several types of drilling techniques are currently employed in oil and gas drilling: straight hole drilling, directional/slant drilling, horizontal drilling, air drilling, and foam drilling. Regardless of the drilling technique, a well bore is typically drilled in a series of progressively smaller-diameter intervals. Thus, a well bore typically exhibits a largest diameter at the surface and relatively smaller diameter at the bottom of the well bore.

Accordingly, existing technologies have limitations relevant to the depth and diameter of the well bore. In this regard, well bores having a wider diameter cannot be drilled as deep as a well bore with a smaller diameter. More specifically, as the well bore depth and diameter increases, tremendous pumping force is required to force rock chips (cuttings) out of the well bore by a fluid (or air) column formed between the drill pipe and the well bore wall.

Exploration and well bore drilling are major cost components of any oil, gas, or geothermal project. Accordingly, there exists a need for a drilling apparatus and a method for drilling a relatively deeper well bore having a relatively wider diameter and reduced drilling cost when compared to conventional drilling technologies to accommodate emerging technology in geothermal energy such as those described in U.S. patent application Ser. No. 12/197,073 entitled "Self Contained In-Ground Geothermal Generators" (SCI-GGG). The mentioned technology/method consist of: Lowering SCI-GGG apparatus deep down into predrilled well, producing electricity down in the ground and then transporting electricity up to the ground surface by wire. The apparatus can be lowered into well by filling well first with water and then lowering apparatus by gradually empting the well or controlling buoyancy by filling or empting the boiler of the apparatus with fluids.

SUMMARY

For purposes of summarizing the disclosure, exemplary embodiments of systems and methods for drilling a relatively deeper well bore having a relatively wider diameter and reduced drilling cost when compared to conventional drilling technologies have been described herein.

A method for drilling deeper and wider well bores consist of an apparatus having motorized drill head for cutting and shredding ground material; a separate excavation line for transporting cuttings up to the ground surface; a separate line for delivering filtered fluid to the bottom of the well bore; and separate close loop engine cooling line. Excavation line consists of multiple connected segments of the stationary main pipe with periodical segments of in-line excavation pumps. Alternatively, in another embodiment, excavation line consists of multiple connected segments of a stationary (not rotating) main pipe with rotating continues screw inside and configured to move mud and cuttings upward. Close loop cooling line consist of one heat exchanger in the motorized drill head and one on the ground surface in the binary power unit where fluid is cooled and in process electricity produced which can be used as a supplement for powering drill head, pumps, equipment, etc.

Diameter of the excavation line and rate of flow of mud and cuttings through it and diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only limited fluid column at the bottom of the well bore. The excavation process continues regardless of diameter of the drill head (well bore) and therefore this method eliminates well known drilling limitations relative to depth and diameter of the well bore.

These and other features of the subject matter described herein will be more readily apparent from the detailed

description of the embodiments set forth below taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram and cross sectional view of an apparatus and method for drilling a well bore in accordance with one embodiment;

FIG. **2** is a schematic diagram and cross sectional view of a binary geothermal power plant on the ground surface in accordance with one embodiment;

FIG. **3** is enlarged cross sectional view taken along line **3-3'** of FIG. **8** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **4** is a cross sectional view taken along line **4-4'** of FIG. **3** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **5** is a cross sectional view taken along line **5-5'** of FIG. **3** of an in-ground motorized drill head illustrating a hydraulic system for deviation control in accordance with one embodiment;

FIG. **6** is a cross sectional view taken along line **6-6'** of FIG. **3** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **7** is a cross sectional view taken along line **7-7'** of FIG. **3** of an in-ground motorized driven drill head in accordance with one embodiment;

FIG. **8** is a cross sectional view taken along line **8-8'** of FIG. **3** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **9** is a cross sectional view taken along line **9-9'** of FIG. **10** of a hydraulic mechanism that is part of an in-ground motorized drill head in accordance with one embodiment;

FIG. **10** is a cross sectional view taken along line **10-10'** of FIG. **9** of a hydraulic mechanism that is part of an in-ground motorized drill head in accordance with one embodiment;

FIG. **11** is a cross sectional view taken along line **11-11'** of FIG. **12** of an excavation pump in accordance with one embodiment;

FIG. **12** is a cross sectional view taken along line **12-12'** of FIG. **11** of an excavation pump in accordance with one embodiment;

FIG. **13** is a schematic diagram of cross sectional view of an apparatus and method for drilling a well bore in accordance with another embodiment;

FIG. **14** illustrates an enlarged cross sectional view taken along line **14-14'** of FIG. **18** of the in-ground motorized drill head shown in FIG. **13**.

FIG. **15** is a cross sectional view taken along line **15-15'** of FIG. **14** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **16** is a cross sectional view taken along line **16-16'** of FIG. **14** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **17** is a cross sectional view taken along line **17-17'** of FIG. **14** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **18** is a cross sectional view taken along line **18-18'** of FIG. **14** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **19** is a cross sectional view taken along line **19-19'** of FIG. **20** of a hydraulic deviation control mechanism in accordance with one embodiment;

FIG. **20** is a cross sectional view taken along line **20-20'** of FIG. **19** of a hydraulic deviation control mechanism in accordance with one embodiment;

FIG. **21** is a cross sectional view taken along line **21-21'** of FIG. **22** of a crossing box in accordance with one embodiment;

FIG. **22** is a cross sectional view taken along line **22-22'** of FIG. **21** of a crossing box in accordance with one embodiment;

FIG. **23** is a cross sectional view taken along line **23-23'** of FIG. **22** of a crossing box in accordance with one embodiment;

FIG. **24** is a cross sectional view taken along line **24-24'** of FIG. **25** of a set of excavation pumps in accordance with one embodiment;

FIG. **25** is a cross sectional view taken along line **25-25'** of FIG. **24** of the excavation pumps assembly shown in FIG. **24**;

FIG. **26** is a schematic diagram and cross sectional view of an apparatus and method for drilling a well bore in accordance with another embodiment;

FIG. **27** illustrates an enlarged cross sectional view taken along line **27-27'** of FIG. **28** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **28** is a cross sectional view taken along line **28-28'** of FIG. **27** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **29** illustrates an enlarged cross sectional view of an in-ground motorized drill head in accordance with one embodiment; and

FIG. **30** is a cross sectional view of the main excavation line shown in FIG. **26**.

FIG. **31** illustrates an enlarged cross sectional view taken along line **31-31'** of FIG. **32** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **32** is a cross sectional view taken along line **32-32'** of FIG. **31** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **33** is a cross sectional view taken along line **33-33'** of FIG. **31** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **34** is a cross sectional view taken along line **34-34'** of FIG. **31** of an in-ground motorized drill head in accordance with one embodiment;

FIG. **35** is a cross sectional view taken along line **35-35'** of FIG. **36** of an in-line pump in accordance with one embodiment;

FIG. **36** is a cross sectional view taken along line **36-36'** of FIG. **35** of the in-line pump assembly shown in FIG. **35**;

FIG. **37** is a cross sectional view taken along line **37-37'** of FIG. **39** of an in-line pump in accordance with one embodiment;

FIG. **38** is a cross sectional view taken along line **38-38'** of FIG. **37** of an in-line pump in accordance with one embodiment;

FIG. **39** is a cross sectional view taken along line **39-39'** of FIG. **37** of an in-line pump in accordance with one embodiment;

FIG. **40** is a cross sectional view taken along line **40-40'** of FIG. **41** of an heat resistant container in accordance with one embodiment;

FIG. **41** is a cross sectional view taken along line **41-41'** of FIG. **40** of an heat resistant container in accordance with one embodiment;

DETAILED DESCRIPTION

In this disclosure illustrated are only a new apparatus and methods but not elements known in existing technologies and processes which are necessary and required in any drilling process like power providing systems, hoisting system, safety measure which includes casing, blow out preventer, etc.

Referring now to FIGS. **1**, **2** and **3**; here is illustrated schematic diagram and cross sectional view of an apparatus and a method **100** for drilling faster, deeper and wider well bore comprising the steps of:

Cutting and shredding bottom of the well bore **110** with motorized drill head **20**;

Transporting mud and cuttings through a separate excavation line **70** up to the ground surface;

Delivering filtered fluid through a separate delivery line (tubes **106** and **108**) to the bottom of the well bore; and

Cooling the motorized drill head through a separate close loop cooling line (tubes **114** and **116**) exchanging heat on the ground surface in a binary power unit **180** and in process producing electricity.

In-ground motorized drill head **20**, connected to lowest section of the main excavation pipe **70**, consist of electric motor **40** having central rotor **46** and peripheral rotors **44** for powering electromotor **40** and are securely engaged with a drill bit **30**; a motor housing block **42** having inner chamber **72** and outer chamber **74** each connected to the separate close loop lines for cooling the motorized drill head **20**; a drill bit **30** consist of two rotating elements, peripheral drill bit **32** and central drill bit **34** securely engaged with rotors **46** and **44** rotating in opposite directions, cutting and shredding bottom of the well bore to a small bits (cuttings); a hydraulic control mechanism (system) **50** providing vertical sliding motion of the peripheral rotor **44**, adjusting distance between shredding surfaces of drill bits permitting selected sizes of shredded material to be sucked into collection chamber **10** for temporally storing before being scrapped and directed into hollow cylindrical shaft **140** for excavation up to the ground surface; a switches compartment **60** a mechanism for controlling (locking) rotation either peripheral drill bit **32** or central drill bit **34**; a deviation control mechanism (system) **80** consisting of at least three sets of peripheral plates **82** pivotally engaged through hydraulics **81** to the motorized drill head housing **42**; and cooling system inside motor housing block **42** having inner chamber **72** and outer chambers **74** each connected to the separate close loop lines for cooling the motorized drill head **20**.

Excavation system consists of: motorized drill head **20** which consist of electric motor **40** which rotates peripheral drill bit **32** and central drill bit **34** in opposite directions, cuts and shreds bottom of the well bore to a small cuttings; a collection chamber **10** formed between extended wall **45** of the motor housing **42** and perforated section **47** of the central hollow shaft **140** for temporally storing mud and cuttings before is being scraped and directed through provided openings **48** into central hollow shaft **140**; The cylindrical hollow shaft **140** of the of electro motor **40** is equipped with spiral blade **142** therein and configured to move mud and cuttings upward into main excavation pipe **70** functioning as a first in-line excavation pump. The excavation pipe string **70** consists of multiple connected segments of the main pipes. Before the excavation pipe is fully inserted into the well bore, another section of excavation pipe is added. On the ground surface there is one pipe **105** with two adjustable joints **109** and **111** and one L-bow connection element **113** enabling additional section of the excavation pipe **70** to be added. Series of in-line excavation pumps **90** are periodically inserted along the excavation pipe **70** wherein each of the in-line excavation pumps **90** are electromotor comprising spiral blade **142** within a hollow central shaft of the rotor creating a force to move mud and cuttings upward to the next in-line excavation pump for pumping mud and cuttings up to the ground surface and out of the well bore, where mud and cuttings are passing through shale shaker **125** where cuttings are separated from mud and then through shale slide **126** convey to the reserve pit **104**. Filtered and cooled fluid from mud pit **104** is reused.

Fluids delivery system consists of pumps **102** located in mud pit **104** on the ground surface; hose line **106** and **108** formed of plurality of hose sections which transports filtered fluids from mud pit **104** to the bottom of the well bore **110**; The fluids circulates through outer peripheral chamber **74** of the motor block **42** of the drill head **20** and provide additional cooling of the motor block **42** before is dispersed into bottom of the well bore **110** where it forms fluids column **112** of only several yards around motorized drill head **20**, cools drill head and provide fluids for drilling; The fluid column **112** can be full length to the surface, if needed, to control subsurface fluids and structural integrity of the well bore but not for removal of the rock chips (cuttings) as it is the case in conventional drilling technologies. Diameter of the excavation line and rate of flow of mud and cuttings through it and diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only limited fluid column at the bottom of the well bore.

Cooling system consists of: at least two heat exchangers, one representing motor block **42** of the motorized drill head **20** and second one a heat exchanger **184** of the binary power unit **180** at the ground surface; and a separate close loop cooling line **114** and **116** formed of plurality of hose segments extending from inner chamber **72** of the motorized drill head housing **42** to the heat exchanger **184** of the power unit **180**. Illustrated here hose **114** circulates fluids on the way up and hose **116** circulates fluids on the way down. The heat is exchanged in the binary heat exchanger unite **180**, electricity is produced, and cooled fluid returned to the inner chamber **72** of the motorized drill head housing **42** for farther heat exchange. The pumps **122** and **124** provide circulation of fluids through heat insulated hoses **114** and **116**. The fluids circulates through drill head housing **42**, absorbs and transport heat up to the ground surface where heat is exchanged through a heat exchanger **184** of the binary power unit **180** which cools fluid and in process produces electricity which then can be used as supplemental power for motorized drill head and in-line pumps or additional uses during drilling process.

Referring now to FIG. **2**; here is illustrated a schematic diagram of cross sectional view of the binary geothermal power unit **180**, in accordance with the invention partially illustrated in FIG. **1**. Here are illustrated; the heat exchanger **184**, the turbines **230**, the condenser **260** and electric generator **250**. Hot water from motor block **42** of the motorized drill head **20** from deep underground passes through close loop tube **72** into coil **182** inside heat exchanger **184** where its heat is transferred into a second (binary) liquid, such as isopentane, that boils at a lower temperature than water. When heated, the binary liquid flashes to vapor, which, like steam, expands across, passes through steam pipe **222** and control valve **288** and then spins the turbine **230**. Exhausted vapor is then condensed to a liquid in the condenser **260** and then is pumped back into boiler **220** of the heat exchanger **184** through feed pipe **214** and boiler feed pump **212**. In this closed loop cycle, vapor is reused repeatedly and there are no emissions to the air. The shaft of the turbines **230** is connected with shaft of the electric generator **250** which spins and produces electricity, which is then transported through electric cable **277** to transformer and grid line to the users. (Transformer and grid line are not illustrated). Additional cooling of the fluid passing through tube **116** on the way to drill head can be achieved if open pit **216** or alike is accessible.

Referring now to FIG. **3**; here is illustrated enlarged cross sectional view, taken along line **3-3'** of FIG. **8**, of the in-ground motorized drill head **20**. Here are illustrated main parts and explained their function. The electric motor **40**, motor housing **42** outer rotor **44** and inner rotor **46**; drill bit **30**, which consist of peripheral drill bit **32** and central drill bit **34**; hydraulic control mechanism **50** (illustrated in FIGS. **9** and **10**) which control vertical sliding motion of the peripheral rotor **44** and consequently peripheral drill bit **32** thus adjusting distance between shredding surfaces of drill bits permitting selected sizes of shredded material to be sucked into collecting chamber **10**; rotation control section **60** which control rotation of drill bits **32** and **34** through outer rotor **44** and inner rotor **46** of the motor **40**; deviation control mechanism (system) **80**, consisting of four peripheral plates **82**, **85**, **88** and **135**, pivotally engaged with four sets of hydraulic cylinders **81** and **83**, **84** and **86**, **87** and **89**, **134** and **136** (illustrated in FIG. **5**); cooling system which consist of inner peripheral chamber **72**, outer peripheral chamber **74** formed in motor housing block **42** which surrounds electro motor **40**. Two sets of heath heat insulated tubes **106**, **108** which delivers cooled fluid (mud) trough motor block into bottom of the well bore and another sets of heat insulated tubes **114** and **116** which are part of closed loop system which circulate fluids through inner peripheral chamber **72** and exchange heat on ground surface trough binary power unit **180** (illustrated in FIGS. **1** and **2**). The hollow shaft (pipe) **140** is central element of the inner rotor **46** and is attached to the central drill bit **34**. The central hollow shaft **140** is equipped with spiral blade **142** therein and configured to move mud and cuttings upward into main excavation line **70** functioning as a first in-line excavation pump.

The motor housing block **42** consist of three peripheral cylinders **73**, **75** and **77** which form two peripheral chambers **72** and **74** which surrounds inner rotor **46** and outer rotor **44** of the electric motor **40**. Inner peripheral chamber **72** is connected with heat insulated tubes **114** and **116** which are part of close loop cooling system. Outer peripheral chamber **74** is connected with heat insulated tubes **106** and **108** which are part of fluid delivery system. The motor housing block **42** with its elements is also illustrated and described in FIGS. **6**, **7** and **8**.

Motor housing block **42** is stationary element and is engaged with rotary elements of the motor **40** trough several sets of boll bearings. There are two bearings **144** and **146** positioned between cylinder **49** of outer rotor **44** of the electric motor **40** and stationary motor housing block **42**.

There are several bearings **148** positioned on the several pins which extend from the inner side of the wall of peripheral cylinder **73** of the motor housing **42** and are spread around cylinder and engaged with outer rotor **44** at its upper surface. Their purpose is to prevent vertical sliding motion between outer rotor **44** and stationary motor housing block **42**. Also, there are two bearings **152** and **154** positioned between inner rotor **46** and outer rotor **44** of the electric motor **40**.

Also, there are three bearings **156**, **157** and **158** positioned between inner rotor **46** and stationary motor housing block **42**.

Here are also illustrated four cuffs or sleeves **162**, **164**, **166** and **168** with grooves (races) secured on the central hollow shaft **140** with corresponding grooves on corresponding surface permitting, when activated, sliding vertical motion of the motor housing **42** and outer rotor **44** in respect to inner rotor **46** which is part of hollow central shaft **140**, and engaged with rotating elements of the outer rotor **44** and stationary motor housing **42** with bearings **152**, **154**, **156**, **157** and **158**. Sliding vertical motion of the motor housing **42** and outer rotor **44**, when needed, is activated from control center on the ground (not illustrated) and through hydraulic control section **50** (illustrated in FIG. **9**). The cuff **164** has disc extension with two recesses **171** and **172** (illustrated in FIG. **7**) for receiving pins **173** and **174** which can be activated through electrically controlled switches **175** and **176** located in switch compartment **60** (Illustrated in FIG. **8**) in order to block rotation of the central drill bit **34**.

The rotation control mechanism or switch compartment **60** also contain two additional switches **185** and **186** with pins **187** and **188** which when activated engages with corresponding cavities in upper portion of the outer rotor **44** in order to block rotation of the peripheral drill bit **32**. The rotation control mechanism or switch compartment **60** provides an optional function. Electrically controlled switches with pins can stop rotations of either outer or inner rotor otherwise rotors rotate in opposite directions and are balanced.

In-ground motorized drill head **20** further contain set of bearings **192** and **194** positioned between rotating hollow shaft **140** which is central element of the inner rotor **46** of the electric motor **40** and the lowest section of the stationary excavation pipe **70** (illustrated in FIG. **9**).

In-ground motorized drill head **20** also contain hydraulic control mechanism **50** positioned on the upper portion of the motor housing **42** (Illustrated in FIGS. **9** and **10**). The purpose for hydraulic mechanism **50** is to pull up the stationary motor housing block **42** and outer rotor **44** which is engage with peripheral drill bit **32** in order to provide greater distance between shredding surfaces of the central drill bit **34** and peripheral drill bit **32**. Distance between shedding surfaces of the central and peripheral drill bits **34** and **32** determine size of the cuttings. The peripheral drill bit **32** is illustrated with dash line in extended position.

In-ground motorized drill head **20** further contain deviation (or direction) control mechanism (system) **80** positioned at the lower section of the stationary motor housing block **42**. Deviation control mechanism **80** consists of four peripheral plates each pivotally engaged with set of hydraulic arms (Illustrated in FIG. **5**). When selected set of cylinders is activated and extends its pistons arms the peripheral plate which pivots them also extend and pushes against wall of the well bore providing movement of the whole drill head in opposite direction and forces drill head to gradually change direction.

Here is also illustrated a collection chamber **10** formed between extended wall (cylinder) **45** of the motor housing **42** and perforated section **47** of the central hollow shaft **140**. Mud and cuttings is temporally stored into collection chamber **10** before is being scraped and directed through provided openings **48** into central hollow shaft **140**. The shaft **140** at the bottom is solid and is mounted to the central drill bit **34**.

FIG. **4** is a cross sectional view taken along line **4-4'** of FIG. **3** of an in-ground motorized drill head **20**. Here in FIG. **4** is illustrated drill bit **32** with three recesses **28** which forms a three-teethed peripheral drill bit **32**. Also, here are illustrated collecting chamber **10** formed between extended wall **45** of the cylinder **49** of the outer rotor **44** and enlarged diameter **47** of the hollow shaft **140** with openings **48** on it. Also, here are visible peripheral plates **82**, **85**, **88** and **135** of the deviation control mechanism.

FIG. **5** is a cross sectional view taken along line **5-5'** of FIG. **3** of an in-ground motorized drill head **20** through deviation control system **80**. Here in FIG. **5** is illustrated hydraulic system **80** for deviation control already explained and partially illustrated in FIG. **3**. Deviation control system **80** consists of four peripheral plates **82**, **85**, **88** and **135** with eye brackets **18** fixed on their inner sides. Four peripheral plates **82**, **85**, **88** and **135** are pivotally engaged with piston arms of four pairs of opposing hydraulic cylinders **81** and **83**, **84** and **86**, **87** and **89**, **134** and **136** and secured with pivot pins **11**. There are four bars **196**, **197**, **198** and **199** extending from the bottom of peripheral cylinder **75** of the housing of the motor block **42**. Two hydraulic cylinders are pivotally secured to each extended bar. The bar **196** is engaged with cylinders **81** and **84**. The bar **197** is engaged with cylinders **86** and **87**. The bar **198** is engaged with cylinders **89** and **134**. The bar **199** is engaged with cylinders **83** and **136**. When selected set of cylinders is activated and extends its pistons arms the peripheral plate which pivots them also extend and pushes against wall of the well bore providing movement of the whole drill head in opposite direction and forces drill head to gradually change direction. Extended position of the peripheral plate **82** is illustrated with dash lines.

FIG. **6** is a cross sectional view taken along line **6-6'** of FIG. **3** of an in-ground motorized drill head **20**. Here in FIG. **6** are illustrated main elements already explained and partially illustrated in FIG. **3**; The hollow shaft **140** with continues spiral blades **142** inside and electromagnetic coil **41** which is fix element of the inner rotor **46**; electromagnetic coil **43** with cylinder **49** which is fix element of the outer rotor **44**; motor housing block **42** which consist of three peripheral cylinders **73**, **75** and **77** which form two peripheral chambers **72** and **74** which surrounds inner rotor **46** and outer rotor **44** of the electric motor **40**. Peripheral cylinders **73**, **75** and **77** are interconnected with discontinues structural ribs **25** which can be positioned strait vertical or spiraled to guide fluids through chambers in order to absorbs heat and cool motorized drill head **20** more effectively. Also, here are visible four peripheral plates **82**, **85**, **88** and **135**, which are elements of the deviation control system **80** illustrated in more details in FIGS. **3** and **5**). Also, visible here is peripheral drill bit **32**.

FIG. **7** is a cross sectional view taken along line **7-7'** of FIG. **3** of an in-ground motorized drill head **20**, through rotation control mechanism or switch compartment **60**. Here in FIG. **7** are illustrated: hollow shaft **140** with continues spiral blade **142**; disc extension of the cuff **164** with two recesses **171** and **172** for receiving pins **173** and **174** (illustrated in FIG. **8**) which can be activated through electrically controlled switches **175** and **176** located in switch compartment **60** (illustrated in FIG. **8**) in order to block rotation of the shaft **140** and consequently central drill bit **34**.

The rotation control mechanism or switch compartment **60** also contain two additional switches **185** and **186** with pins **187** and **188** (illustrated in FIG. **8**) which when activated engages with corresponding cavities **177** and **178** located in upper portion of the outer rotor **44** in order to block rotation of the outer rotor **44** and consequently peripheral drill bit **32**. Also, here are illustrated several bearings **148** positioned on the several pins which extend from the inner side of the wall of peripheral cylinder **73** of the motor housing **42** and are spread around cylinder and engaged with outer rotor **44** at its upper surface. The purpose of bearings **148** is to prevent vertical sliding motion between outer rotor **44** and stationary motor housing block **42** (illustrated in FIG. **3**). Also, illustrated here are three peripheral cylinders **73**, **75** and **77** which form two peripheral chambers **72** and **74**. Also, illustrated here are discontinue structural ribs **25**, peripheral plates **82**, **85**, **88** and **135** and peripheral drill bit **32** which and are explained earlier.

FIG. **8** is a cross sectional view taken along line **8-8'** of FIG. **3** of an in-ground motorized drill head **20**, through rotation control mechanism or switch compartment **60**. Here are illustrated hollow shaft **140** with continues spiral blade **142**; cuff **164**; bearing **156**; electrically controlled switches **175** and **176** with their pins **173** and **174** which when activated engages with corresponding recesses **171** and **172** located on the cuff **164** (illustrated in FIG. **7**) in order to block rotation of the inner rotor **46** and consequently central drill bit **34**. Also, illustrated are electrically controlled switches **185** and **186** with their pins **187** and **188** (illustrated in FIG. **3**) which when activated engages with corresponding cavities **177** and **178** (illustrated in FIG. **7**) located in upper portion of the outer rotor **44** in order to block rotation of the outer rotor **44** and consequently peripheral drill bit **32**. Also, illustrated are three peripheral cylinders **73**, **75** and **77** which form two peripheral chambers **72** and **74**; discontinue structural ribs **25**; peripheral plates **82**, **85**, **88** and **135** and peripheral drill bit **32** which and are explained earlier. The rotation control mechanism or switch compartment **60** provides an optional function. Electrically controlled switches with pins can block rotations of either outer or inner rotor otherwise rotors rotate in opposite directions and are balanced.

FIG. **9** is a cross sectional view taken along line **9-9'** of FIG. **10** of a hydraulic mechanism **50** for adjustment of drill bits and selection of cuttings size.

Here is illustrated hydraulic control mechanism (system) **50** positioned on the upper portion of the motor housing **42**. The hydraulic mechanism **50** contains four hydraulic cylinders **51**, **52**, **53**, and **54** (Illustrated in FIG. **10**) with their engaged piston arms **55**, **56**, **57** and **58**, and springs **61**, **62**, **63** and **64** and container **65** for hydraulic fluid. One end of the pistons arm **55**, **56**, **57** and **58** is fixed to the platform **66** which through extended neck **68** is extended part of the motor housing block **42**. The other end of the cylinders **51**, **52**, **53**, and **54** are fixed to the platform **67** on which hydraulic fluid container **65** with necessary pumps and hoses (not illustrated) is located. The platform **67** has extended sleeve **23** which surrounds and is fixed to the lowest section of the stationary excavation pipe **70**. The platform **66**, extended shaft **68** and motor housing block **42** are supported with structural plates **22**. The purpose for hydraulic system **50** is to pull up the stationary motor housing block **42** and outer rotor **44** which is engage with peripheral drill bit **32** in order to provide greater distance between shedding surfaces of the central drill bit **34** and peripheral drill bit **32**. Distance between shedding surfaces of the central and peripheral drill bits determines size of the cuttings.

FIG. **10** is a cross sectional view taken along line **10-10'** of FIG. **9** of a hydraulic compartment **50** for adjustment of drill bits and selection of cuttings size. Here are illustrated bearing **192** positioned between rotating hollow shaft **140** which is central element of the inner rotor **46** of the electric motor **40** and the lowest section of the stationary excavation pipe **70** (illustrated in FIG. **9**); Also, here are illustrated four hydraulic cylinders **51**, **52**, **53**, and **54** explained earlier in FIGS. **3** and **9**. Also, illustrated are two sets of heat insulated tubes **106**, **108** which delivers cooled fluid (mud) trough motor block into bottom of the well bore and another sets of heat insulated tubes **114** and **116** which are part of closed loop system which circulate fluids through inner peripheral chamber **72** and exchange heat on ground surface trough binary power unit **180** (illustrated in FIGS. **1**, **2** and **9**). Also, illustrated are structural plates **22** which support platform **66**, extended shaft **68** and motor housing block **42**. Here is also illustrated electric cable **15** for supplying electric power to the motor head **20** and various sensors (not illustrated). Also, illustrated are peripheral plates **82**, **85**, **88** and **135** and peripheral drill bit **32** which are explained earlier.

In FIGS. **9** and **10** a hydraulic system **50** is illustrated although as an alternative electro mechanical mechanism could be used as well.

FIG. **11** is a cross sectional view taken along line **11-11'** of FIG. **12** of an in-line excavation pump **90** which is a segment of an apparatus for drilling faster, deeper and wider well bore, illustrated in FIG. **1**. Excavation in-line pump **90** is a replaceable segment in excavation line **70**. In-line excavation pump **90** is an electro motor **91** consisting of a rotor **92** and a stator **94**. The rotor **92** consists of a hollow shaft **240** which is fixedly surrounded with an electromagnetic coil **93**. The stator **94** consists of a cylinder **96** which is housing of the motor **91** and is fixedly engaged with electromagnetic coil **95**. Stator **94** and rotor **92** are engaged through two sets of ball bearings **97** and additional set of sealant bearings **98**. The cylinder **96** of the motor **91** has diameter reduction on each end and is aligned with the segments of the main excavation pipe **70**. The hollow shaft **240** has continues spiral blades **242** formed on the inner side of the shaft. When electro motor **91** is activated the hollow shaft **240** which is central element of the rotor **92** rotates and provides suction force at the lower end and pushing force on the upper end of the excavation pump **90**. The mud and cuttings are pumped up through excavation pipe (main pipe) **70** to the next in-line excavation pump for farther pumping. The excavation in-line pump segments **90** are repetitively installed as needed for mud and cuttings to reach ground surface and out of the well bore.

There are two brackets **99** secured on each side of the excavation pump **90** with recesses **118** provided for delivery fluid line tubes **106** and **108**; and for cooling system line tubes **114** and **116** (also illustrated in FIG. **12**). In-line pump **90** can be used for moving material (a substance) of different viscosity upward including mud, oil, water, etc. Alternatively, if used in deepwater oil extraction (production) as a segment of a raiser pipe an additional cylinder can be added surrounding stator cylinder **96** to provide a space which can be filled with oil or air to provide buoyancy to the in-line pump.

FIG. **12** is a cross sectional view taken along line **12-12'** of FIG. **11** of an in-line excavation pump **90** which is a segment of an apparatus for drilling faster, deeper and wider well bore (illustrated and explained in FIGS. **1** and **11**. The in-line excavation pump **90** is an electro motor **91**. Here are illustrated all parts already explained in FIG. **11**. Also, here is illustrated bracket **99** with recesses **118** provided for delivery fluid line tubes **106** and **108** and for cooling system line tubes **114** and **116**. There are several extra recesses **118** for additional lines, if needed. Also here is illustrated transformer box **190** with electric cable line **15** for supplying electric power to the motor head **20**, excavations pump **90** and various sensors, cameras, lights, etc. (not illustrated).

Referring now to FIG. **13**; here is illustrated schematic diagram and cross sectional view of an alternative apparatus and method **200** for drilling faster, deeper and wider well bore. The embodiment **200** is similar to embodiment **100** explained earlier in FIGS. **1-12**.

The apparatus and method **200** comprising the steps of:

Cutting and shredding bottom of the well bore **110** with motorized drill head **21**;

Transporting mud and cuttings through a separate excavation line **270** up to the ground surface;

Delivering filtered fluid through a separate delivery line **107** and tubes **206** and **208** to the bottom of the well bore; and

Cooling the motorized drill head **21** through a separate close loop cooling line (tubes **114** and **116**) exchanging heat on the ground surface in a binary power unit **180** and in process producing electricity. Described herein are only differences.

The in-ground motorized drill head **21** consist of the same major elements explained earlier in motorized drill head **20** with exception deviation control system and a hydraulic control system for providing vertical sliding motion of the peripheral rotor **44** and peripheral drill bit **32**. The deviation control system **120** for tilting drill head **21** is located at the top of motorized drill head **21** and is explained in FIG. **19**.

Excavation system consists of: motorized drill head **21** which cut and shred bottom of the well bore (illustrated in FIG. **14**); excavation pipe **270** which is connected at one end to the motorized drill head **21** and at other end to the crossing box **271**. The crossing box **271** splits flow of pumped mud and cuttings on the way up into two lines (hoses) **272** and **273** (illustrated in FIGS. **21-23**) to increase excavation capacity and to reduce load of single line; Two excavation hoses (tubes) **272** and **273** are main excavation line(s), are formed of plurality of hose segments, connects crossing box **271** and in-line excavation pumps **290** which then pump mud and cuttings to the next excavating pumps segment. The excavation pump sections **290** are repetitively installed, as needed, to for mud and cuttings to reach ground surface and out of the well bore, where mud and cuttings are passed through shale shaker **125** where rock cuttings are separated from mud and then through shale slide **126** conveys to the reserve pit. Then a filtered and cooled fluid from mud pit **104** is pumped back through pump **103** and pipe **105** into main pipe **107** and reused.

Fluids delivery system consists of: a pump **103** located in mud pit **104** on the ground surface; a pipe **105** with two adjustable joints **109** and **111** and one T-shape connection element **115** enabling additional segment of the main pipe **107** to be added. The main pipe **107** is formed of plurality of segments which transports filtered and cooled fluids from mud pit **104** to the crossing box **271**. The crossing box **271** splits flow of filtered and cooled fluids into two lines (hoses) **206** and **208** (illustrated in FIGS. **21-23**) which are connected to outer peripheral chamber **74** of the motor block **42** of the drill head **21** (illustrated in FIG. **14**). Filtered and cooled fluids passes through motor block **42** and provide additional cooling of the motor block **42** and fluid for drilling as explain in embodiment in FIGS. **1** and **3**.

FIG. **14** illustrates an enlarged cross sectional view taken along line **14-14'** of FIG. **18** of an in-ground motorized drill head **21** of an alternative embodiment **200** for drilling faster, deeper and wider well bore, explained in FIG. **13**. The in-ground motorized drill head **21** consist of the same major elements explained earlier in motorized drill head **20**. In this embodiment deviation control mechanism (system) **120** is located at the top of motorized drill head **21** (illustrated and explained in FIG. **19**). In this embodiment there is no a hydraulic control mechanism for providing vertical sliding motion of the peripheral rotor **44** and peripheral drill bit **32**.

FIG. **15** is a cross sectional view taken along line **15-15'** of FIG. **14** of an in-ground motorized drill head **21**. Here in FIG. **15** is illustrated drill bit **32** with three recesses **28** which forms a three-teethed peripheral drill bit **32**. Also, here are illustrated collecting chamber **10** formed between extended wall **45** of the cylinder **49** of the outer rotor **44** and enlarged diameter **47** of the hollow shaft **140** with openings **48** on it.

FIG. **16** is a cross sectional view taken along line **16-16'** of FIG. **14** of an in-ground motorized drill head **21**, in accordance with embodiment. Here in FIG. **16** are illustrated elements almost identical with elements explained and illustrated in FIG. **6**.

FIG. **17** is a cross sectional view taken along line **17-17'** of FIG. **14** of an in-ground motorized drill head **21**, through rotation control section or switch compartment **60**. Here in

FIG. **17** are illustrated elements almost identical with elements explained and illustrated in FIG. **7**.

FIG. **18** is a cross sectional view taken along line **18-18'** of FIG. **14** of an in-ground motorized drill head **21**, through rotation control switch compartment **60**. Here in FIG. **18** are illustrated elements almost identical with elements explained and illustrated in FIG. **8**.

FIG. **19** illustrates deviation control mechanism **120** positioned on the upper portion of the motorized drill head **21**. Deviation control mechanism **120** consists of: a hydraulic system **121** for tilting drill head **21**; and rotating joint junction **150**.

Hydraulic system **121** contains four hydraulic cylinders **51**, **52**, **53**, and **54** (illustrated in FIG. **20**) with their engaged piston arms **55**, **56**, **57** and **58**, and springs **61**, **62**, **63** and **64** and container **65** for hydraulic fluid. One end of the pistons arm **55**, **56**, **57** and **58** is fixed to the platform **66** which through extended neck **68** is extended part of the motor housing block **42**. The other end of the cylinders **51**, **52**, **53**, and **54** are fixed to the platform **67** on which hydraulic fluid container **65** with necessary pumps and hoses (not illustrated) is located. The platform **67** has extended sleeve **23** which surrounds and is fixed to the lowest section of the stationary excavation pipe **270**. The platform **66**, extended shaft **68** and motor housing block **42** are supported with structural plates **22**. Hydraulic cylinders **121** are activated (contracted or extended individual or in pairs), when needed, to provide tilt of the drill head **21** in order to adjust direction of drilling.

Rotating joint junction **150** is a place where rotating hollow shaft **140**, which is central element of the electric motor **40** joint stationary section of the main pipe **270**. The rotating hollow shaft **140** and stationary section of the main pipe **270** are engaged through spherical shape channeled bushing **170**, a set of spherical support pillows **193** and **195** and set of bearings **192** and **194**.

FIG. **20** is a cross sectional view taken along line **20-20'** of FIG. **19** of an deviation control mechanism **120** of an alternative embodiment **200** illustrated in FIG. **13**, Here is illustrated flange of hollow shaft **140**; spherical shape channeled bushing **170**; spherical support (pillow) **193**; four hydraulic cylinders **51**, **52**, **53**, and **54** with their engaged piston arms **55**, **56**, **57** and **58**. Also, here are illustrated platform **66**; structural plates **22**; peripheral drill bit **32**; heat insulated tubes **114** and **116** which are part of closed loop system which circulate fluids through inner peripheral chamber **72** and exchange heat on ground surface trough binary power unit **180** and heat insulated tubes **106**, **108** which delivers cooled fluid (mud) trough motor block into bottom of the well bore (illustrated in FIGS. **13**, **14**, **19**). Also here is illustrated electric cable **15** for supplying electric power to the motor head **21** and various sensors (not illustrated). In FIGS. **19** and **20**, hydraulic mechanism **120** is illustrated although other mechanisms like electro mechanical mechanism with treaded rods could be used as well.

FIGS. **21-23** are cross sectional views of a crossing box **271** a segment of the embodiment **200** for drilling faster, deeper and wider well bore illustrated in FIG. **13**. FIG. **21** is a cross sectional view taken along line **21-21'** of FIG. **22** of a crossing box **271** an element for directing fluids flow illustrated in FIG. **13**, in accordance with the embodiment **200**. The crossing box **271** is located between excavation pipe **270** and main pipe **107**. The crossing box **271** (illustrated in FIGS. **13**, **21-23**) has two joining channels **274** and **275** which splits and directs flow of pumped mud and cuttings on the way up from excavation pipe **270** into two lines **272** and **273** which are main excavation line. Two excavation hoses (tubes) **272** and **273** are formed of plurality of hose segments and connect crossing box **271** and in-line excavation pumps **290** which then pump mud and cuttings to the next excavating pump segments. The crossing box **271** also has two additional joining channels **202** and **204** which splits and directs filtered fluid flow from main pipe **107** on the way down into two lines (hoses) **206** and **208** (illustrated in FIGS. **22** and **23**) which are connected to outer peripheral chamber **74** of the motor block **42** of the drill head **21** (illustrated in FIG. **14**) for providing additional cooling of the motor block **42** before is released into bottom of the well bore **110**.

FIG. **22** is a cross sectional view taken along line **22-22'** of FIG. **21** of a crossing box **271** explained in FIG. **21**. Here are illustrated joining channels **274** and **275** which splits and directs flow of pumped mud and cuttings on the way up from excavation pipe **270** into two lines **272** and **273** (illustrated in FIG. **21**) and also joining channels **202** and **204** which splits and directs filtered fluid flow from main pipe **107** on the way down into two lines (hoses) **206** and **208** (illustrated in FIG. **23**). Here are also illustrated heat insulated tubes **114** and **116** which are part of closed loop system which circulate fluids through inner peripheral chamber **72** and exchange heat on ground surface trough binary power unit **180** (illustrated in FIG. **13**). Also here is illustrated electric cable **15** for supplying electric power to the motor head **21** and various sensors (not illustrated).

FIG. **23** is a cross sectional view taken along line **23-23'** of FIG. **22** of a crossing box **271** explained in FIG. **21**. Here are illustrated joining channels **202** and **204** which splits and directs filtered fluid flow from main pipe **107** on the way down into two lines (hoses) **206** and **208** (also illustrated in FIG. **22**) which are connected to outer peripheral chamber **74** of the motor block **42** of the drill head **21** (illustrated in FIG. **14**).

FIG. **24** is cross sectional views of an assembly **210** of two excavation pump **290** and main pipe **107** that represent one segment of the apparatus **200** taken along line **24-24'** of FIG. **25**. Assembly **210** is replaceable segment in apparatus **200**. In-line excavation pump segments **290** (illustrated in FIGS. **13**, **24** and **25**) is repetitively installed in the excavation line **107** as needed for mud and cuttings to reach ground surface and out of the well bore. In-line excavation pump **290** is identical to the in-line excavation pump **90** already explained in FIGS. **12** and **12**. The cylinder **96** of the motor **91** has diameter reduction on each end and is aligned with the segments of the main excavation hose (pipe) **272**. Second identical excavations pump **290** of the assembly **210** is aligned with excavation hose **273** (also illustrated in FIG. **13**). The mud and cuttings are pumped up through excavation hoses **272** and **273** to the next in-line excavation pump assembly **210** for farther pumping. The excavation in-line pump segments **210** are repetitively installed as needed for mud and cuttings to reach ground surface and out of the well bore. There are two brackets **299** secured on each side of the excavation pump assembly **210** which hold excavation pumps **290** securely.

FIG. **25** is a cross sectional view of the excavation pumps assembly **210** taken along line **25-25'** of FIG. **24**. Shown are the main pipe **107**, two pumps **290** of the assembly **210** with their structural elements; hollow shaft **240** which has continues spiral blades **242** formed on the inner side of the shaft which is central element of the rotor **92** with its electromagnetic coils **93** and stator **94** with its electromagnetic coils **95**. Here is also illustrated bracket **299** with recesses **118** provided for cooling system line tubes **114** and **116** which are part of closed loop system which circulate fluids through inner peripheral chamber **72** and exchange heat on ground surface trough binary power unit **180** (illustrated in FIGS. **13** and **14**). Also, here is illustrated transformer box **191** with electric cable line **15** for supplying electric power to the motor head **21**, excavations pump **290** and various sensors, cameras, lights, etc. (not illustrated).

FIG. **26** is a schematic diagram of an alternative drilling apparatus and method **300** for drilling faster, deeper and wider well bore. The embodiment **300** is similar to embodiment **100** explained earlier in FIGS. **1-12**, however, excavation system is different. The apparatus and method **300** also comprising the steps of:

Cutting and shredding bottom of the well bore **110** with motorized drill head **24**;

Transporting mud and cuttings through a separate excavation line **71** up to the ground surface;

Delivering filtered fluid through a separate delivery line (tubes **106** and **108**) to the bottom of the well bore **110**; and

Cooling the motorized drill head **24** through a separate close loop cooling line (tubes **114** and **116**) exchanging heat on the ground surface in a binary power unit **180** and in process producing electricity. Described herein are only differences.

The motorized drill head **24** is part of excavation system and consist of the same major parts explained earlier in motorized drill head **20**, however, the continuous spiral blade **142** (FIG. **3**) of the electric motor **40** is replaced with a continuous screw **143** which extend through whole length of the excavation pipe **71** to excavate mud and cuttings from the bottom of the well bore **110** up to the ground surface.

On the ground surface there is one pipe **105** with two adjustable joints **109** and **111** enabling additional section of the excavation pipe **71** to be added (illustrated in FIG. **26**). The pipe **105** with adjustable joints **111** is connected to the mud releaser **117** which is connected to the top section of the excavation line **71**. The continues screw **143** which is formed of plurality of connected sections is inserted into main excavation pipe through all length of the excavation line **71** and is rotated (powered) through turning mechanism **138** which is part of the power system which includes engines, extended platforms **133**, turn table and transmission system which is similar to conventional systems used for turning drill pipe. The continues screw **143** excavates mud and cuttings up to the ground surface through excavation line **71** and out of the well bore where mud and cuttings are passing through shale shaker **125** where rock cuttings are separated from mud and then through shale slide **126** convey to the reserve pit. Then, a filtered and cooled fluid from mud pit **104** is pumped back through pumps **102** into fluid delivery line **106** and **108** and reused.

FIG. **27** is an enlarged cross sectional view of an in-ground motorized drill head **24** taken along line **27-27'** of FIG. **28**. The motorized drill head **24** is similar to the motorized drill head **20** shown in FIGS. **3-10**, however, the continuous spiral blade **142** (FIG. **3**) of the electric motor **40** is replaced with continuous screw **143** to excavate mud and cuttings from the bottom of the well bore **110** up to the ground surface.

As with the drill head **20** shown in FIG. **3**, the in-ground motorized drill head **24** includes a collecting chamber **10** and a drill bit **30** to shred rock into small bits (cuttings). The hollow shaft **140** at this section of the collecting chamber **10** has an enlarged diameter and elongated openings **48** for mud and cuttings to pass to the excavation line.

The elongated openings **48** on one side have extended blades **37** tilted at an angle to scrape mud and cuttings from the collecting chamber **10** and direct them into the hollow shaft **140** through the openings **48** (also illustrated in FIG. **27**) as well as providing additional sucking and pushing force.

The shaft **140** at the bottom is solid and provides recess for bearing **145** which is engaged with continues screw **143**. Here is also illustrated opposite directions of rotation of the continuous screw **143** and the hollow shaft (pipe) **140** which is central part of the inner rotor **46** of the electric motor **40**.

Mud and cuttings from the collecting chamber **10** pass through openings **48** into the hollow shaft **140** and are transported through the main excavation line **71** by the continuous screw **143** to the surface, separated, analyzed, and pumped back through the peripheral chamber of the motor block to provide cooling to the motor block before the fluid is released into the well bore where the fluid forms a fluid column of several yards high around motor block, cools drill bit, and provides fluid for drilling.

FIG. **28** is a cross sectional view of the in-ground motorized drill head **24** taken along line **28-28'** of FIG. **27**. Shown is drill bit **32** with recesses **28** that form a three-toothed peripheral drill bit **32**. Also shown are the collecting chamber **10** formed between extended wall **45** of the cylinder **49** and the enlarged diameter **47** of the hollow shaft **140** having enlarged openings **48** having on one side blades **37** extending towards peripheral wall **45** of the collection chamber **10** for scraping and directing mud and cuttings from collection chamber **10** into hollow shaft **140** where continues screw **143** transport it up to the ground surface. Also shown are the peripheral plates **82**, **85**, **88**, **135** of the deviation control mechanism explained and illustrated in FIG. **4**.

FIG. **29** is an enlarged cross sectional view of an alternative drilling apparatus and method for drilling a well bore in accordance with another embodiment. Shown is a motorized drill head **26**, identical to the motorized drill head **24** shown in FIG. **27**, except the continuous screw **143** extends through and is engaged with the central drill bit **34** through a set of bearings **147**, **149** and function as additional drill bit **151** with is own pace powered from the ground surface. Here are also shown directions of rotations of the continuous screw **143** and drill head **151** in respect to central and peripheral drill bits **34** and **32** which are opposite to each other.

FIG. **30** is a cross sectional view of the main excavation line **71** shown in FIG. **26**. The excavation line **71** is formed of a plurality of connected sections of the main pipe and a plurality of connected sections of the continuous screw **143**. The main pipe **71** does not rotate with the exception of the hollow shaft **140** at the motorized drill head. Also shown is the direction of rotation of the continuous screw **143**.

Referring now to FIGS. **31**, **32**, **33** and **34**; FIG. **31** illustrates an enlarged cross sectional view of an in-ground motorized drill head **27** taken along line **31-31'** of FIG. **32**.

The motorized drill head **27** is similar to the motorized drill head **24** shown in FIGS. **26-27**, and the motorized drill head **26** shown in FIG. **29** however, the drill bit **30** is replaced with drill bit **330** which can increase and decrease its diameter. As with in-ground motorized drill head **24** and **26** shown in FIGS. **27** and **29**, the in-ground motorized drill head **27** includes a collecting chamber **10** and a drill bit **330** to shred rock into small bits (cuttings). The hollow shaft **140** at this section of the collecting chamber **10** has an enlarged diameter and elongated openings **48** for mud and cuttings to pass to the excavation line.

The elongated openings **48** on one side have extended blades **37** tilted at an angle to scrape mud and cuttings from the collecting chamber **10** and direct them into the hollow shaft **140** through the openings **48** (also illustrated in FIG. **27**) as well as providing additional sucking and pushing force. There is also continuous screw **143** to excavate mud and cuttings from the bottom of the well bore **110** up to the ground surface. Here is also illustrated motor housing **42** which is engaged with hydraulic control system **50** which can rise and lower motor housing **42** (illustrated in FIG. **9**). The drill bit

330 consists of peripheral drill bit 332 and central drill bit 334. The peripheral drill bit 332 consists of three equal parts pivotally engaged with central drill bit 334 and motor housing 42. The central drill bit 334 is engaged with ring 225 through bearing 227. The ring 225 has three sets of eye brackets 228 which are pivotally engaged with each of peripheral drill bits 332 through protruded plate 232 and corresponding pin 254. The peripheral drill bits 332 are also pivotally engaged with lower section of motor housing 42 through arms 236. The arms 236 on upper end are engaged with motor housing 42 through eye brackets 238 and corresponding pin 224 and on the lower end with peripheral drill bit 332 through corresponding pin 234. When motor housing 42 is pulled up with hydraulic control system 50 the peripheral drill bits 332 extends outward and increase its diameter. The hollow shaft 140 is engaged with central drill bit 334. The continuous screw 143 which is powered from the ground surface and spins at different speed sits on bearing 340 and is secured with bearing 342. The space between bearings 340 and 342 is sealed and filled with lubricant. When motor housing 42 is lowered with hydraulic control system 50 the peripheral drill bits 332 collapses inward and decreases its diameter.

Contemporary drilling technology is based on drilling subsequent sections with slightly smaller diameter because each preceding section will have casing added. In order to produce the well bore with a constant diameter, the ability to increase and decrease diameter of the drill bit is of great importance.

Here in FIG. 31 the cross sectional view (right side) is slightly of the center in order to illustrates recesses 246 on the peripheral drill bits 332 which engage with pins 248 of the motor housing 42 to secure peripheral drill bits 332 when in extended position. Dash lines 333 represent the peripheral drill bits 332 in extended position.

FIG. 32 is a cross sectional view taken along line 32-32' of FIG. 31. Here is illustrated drill bit 330 including three peripheral drill bits 332 bearing 227, ring 225 with eye brackets 228, arms 236, recesses 246 and pins 248 of the motor housing 42 with their function already explained in FIG. 31.

FIG. 33 is a cross sectional view taken along line 33-33' of FIG. 31. Here is illustrated drill bit 330 including three peripheral drill bits 332 bearing 227, ring 225 with eye brackets 228, arms 236 with their function already explained in FIG. 31.

FIG. 34 is a cross sectional view taken along line 34-34' of FIG. 31. Here is illustrated drill bit 330 including three peripheral drill bits 332 and central drill bit 334. Here are also illustrated teeth 336 on the central drill bit 334 and teeth 338 on the peripheral drill bits 332. The peripheral drill bits 332 has to be in extended position (dash line) to grind rocks to the size of distance between teeth of peripheral drill bit 332 and central drill bit 334.

FIG. 35 is a cross sectional view of an in-line pump 280 taken along line 35-35' of FIG. 36. The in-line pump 280 is similar to the in-line excavation pump 90 illustrated and explained in FIGS. 11 and 24 however, assembly 280 has a cooling system similar to cooling system used in cooling motorized drill head 20, 21, 24 and 26 illustrated and explained in FIGS. 3, 14, 27 and 29. The cooling system can prevent from overheating and also enable in-line pump to function in hot environment such is in well bore for geothermal applications. The in-line pump 280 can be used in many different applications including as excavation pump and/or inline pump for circulating fluid substance. The in-line pump 280 has an additional cylinder 296 which forms additional compartment 297 between motor cylinder 96 and cylinder 296. The compartment 297 is filled with fluid which circulates in closed loop system absorbing heat generated from motor and hot rocks and transporting it up to the ground surface through thermally insulated pipe system. The hot fluid line 114 on the way up can be connected with other hot fluid lines or can be individually coupled to the heat exchanger in the binary power unit where heat can be used for production of electricity.

If in-line pump 280 is used in vertical position two brackets 99 (illustrated in FIGS. 11 and 12) with recesses 118 can be provided and used for securing different lines including electric, sensors, cameras, lubrication system line, etc. In-line pump 280 can be used for moving material (a substance) of different viscosity upward including mud, oil, water, etc. Alternatively, if used in deepwater oil extraction (production) as a segment of a raiser pipe the compartment 297 be filled with oil or air to provide buoyancy to the in-line pump 280.

FIG. 36 is a cross sectional view of the in-line pump 280 taken along line 36-36' of FIG. 35. Here is illustrated hollow shaft of 240 with continues spiral blade 242, rotor 92, stator 94 cylinder of the motor 96 and peripheral cylinder 296, the housing of the in-line pump 280 and compartment 297 filled with cooling fluid which function is explained in FIG. 35.

FIG. 37 is a cross sectional view of an alternative in-line pump 310 taken along line 37-37' of FIG. 39. The in-line pump 310 is similar to the in-line pump 280 illustrated and explained in FIGS. 35 and 36 however, assembly 310 has an additional closed loop cooling system consisting of additional heat exchange 268 formed of coiled tube 266 placed inside compartment 297. The heat exchanger 268 is connected with additional heat exchanger on the ground surface (not shown in this illustration) through thermally insulated closed loop line consisting of hot line 314 and cool line 316 (illustrated in FIG. 38). Advantages of the assembly 310 is to provide more effective cooling of the electro motor and at same time providing adjustable buoyancy of the in-line pump if submerged in water. Here is also illustrated thermal insulator 302 to protect in-line pump 310 from external heat.

FIG. 38 is a cross sectional view of the in-line pump 310 taken along line 38-38' of FIG. 37. Here are illustrated main line 70 and two sets of thermally insolated pipes of two separate heat exchange systems explained in FIG. 37. One set is hot line 114 and cool line 116 (also illustrated in FIG. 37) which circulate fluid through compartment 297. The second set is hot line 314 and cool line 316 (not shown in FIG. 37) which are part of heat exchanger 268 and coiled pipe 266. Additional heat is absorbed and transported through hot line 314 to the heat exchanger on the ground surface (not shown in this illustration) and cooled fluid returned through cool line 316 returned to heat exchanger 268.

FIG. 39 is a cross sectional view of the in-line pump 310 taken along line 39-39' of FIG. 37. Here are shown elements illustrated and explained in FIGS. 37 and 38.

FIG. 40 is a cross sectional view taken along line 41-41' of FIG. 40 of a heat resistant container 320 used for housing different equipment such as sensors, cameras gauges, etc. which are necessary for exploration and maintenance of the presented invention. The container 320 consists of a cavity 322 formed inside inner cylinder 324; an outer cylinder 326; and compartment 328 formed between inner and outer cylinders. The compartment 328 is filed with fluid and is part of closed loop system which circulates fluid through compartment 328, absorbs heat and transports it through thermally insulated pipe 214 up to the ground surface where heat is exchanged in binary power unit (not shown in this illustration) and cooled fluid returned through pipe 216 into compartment 328. The container 320 has port 305 for inserting particular equipment **307** into cavity **322**. Here are also illustrated thermal insulator layer **312**, lowering/rising cable **282** and electric cable **284**.

FIG. **41** is a cross sectional view taken along line **40-40'** of FIG. **41** of an heat resistant container **320** explained in FIG. **40** in accordance with one embodiment.

The foregoing disclosure is not intended to limit the present disclosure to the precise forms or particular fields of use disclosed. As such, it is contemplated that various alternate embodiments and/or modifications, whether explicitly described or implied herein, are possible in light of the disclosure. Having thus described embodiments of the present disclosure, persons of ordinary skill in the art will recognize that changes may be made in form and detail without departing from the scope of the present disclosure.

What is claimed is:

1. An in-ground motorized drill head connected to the lowest section of the main excavation pipe consist of:

a motor housing having at least one chamber for cooling of the motor;

a central and peripheral rotors for powering the electromotor;

a central and peripheral drill bits for cutting and shredding ground material;

a central hollow shaft of the central rotor for moving material upward.

2. The motorized drill head of claim **1**, wherein the motor housing have inner and outer chamber each connected to separate close loop line for cooling the motorized drill head.

3. The motorized drill head of claim **1**, wherein the central and peripheral rotor of the motor are securely engaged with central and peripheral drill bits for cutting and shredding ground material.

4. The motorized drill head of claim **3**, wherein the peripheral drill bits are moveable between a collapsed and extended position, wherein the peripheral drill bits perform cutting operations when in the extended position.

5. The motorized drill head of claim **4**, further comprising hydraulic mechanism which control vertical sliding motion of the peripheral rotor and consequently peripheral drill bit thus adjusting distance between shredding surfaces of drill bits permitting selected sizes of shredded material to be sucked into collecting chamber and then into hollow shaft.

6. The motorized drill head of claim **1**, further comprising the collection chamber formed between extended wall of the motor housing and central hollow shaft of the motor for temporally storing mud and cuttings before is being scraped and directed through provided openings into central hollow shaft.

7. The motorized drill head of claim **6**, wherein provided openings at lower section of the central hollow shaft have extended blades on one side for scrapping and directing muddy material from collecting chamber into hollow shaft to be moved into excavation pipe for transport to the ground surface.

8. The motorized drill head of claim **1**, wherein the inner side of the central hollow shaft of the inner rotor is equipped with spiral blade therein and configured to move the mud and cuttings upward into main excavation line for transport up to the ground surface.

9. The motorized drill head of claim **1**, wherein the inner side of the central hollow shaft is smooth providing space for an independent continues screw extending through whole length of the main excavation pipe and configured to move the mud and cuttings upwards to the ground surface when rotate.

10. The motorized drill head of claim **1**, wherein the main excavation pipe further comprising a series of in-line excavation pumps periodically inserted along the excavation pipe wherein each of the in-line excavation pumps are electromotor comprising spiral blade within a hollow central shaft of the rotor creating a force to move material upward to the next in-line excavation pump.

11. The motorized drill head of claim **1**, further comprising the deviation control mechanism consisting of at least three peripheral plates pivotally engaged through sets of hydraulic arms to the housing of the motorized drill head.

12. The motorized drill head of claim **11**, wherein the correction of the drilling deviation occurs in respond to activation of at least one set of the hydraulics arms and corresponding peripheral plates extending into wall of the well, causing pushing force and equal reaction of the drill head in opposite direction.

13. The motorized drill head of claim **1**, further comprising deviation control system positioned on the upper portion of the motor housing, consisting of at least three sets of hydraulics for tilting motor housing relevant to excavation pipe and rotating joint junction for permitting continuous flow of the mud during tilting process.

14. The motorized drill head of claim **1**, further comprising a rotating joint junction consisting of spherical shape channeled bushing and two sets of bearings with spherical pillows positioned on the upper portion of the motor housing where rotating hollow shaft of the motor engages stationary excavation pipe.

15. A sub-surface drill for removing cuttings from a hole, the drill comprising:

a first excavation pump having a drill head connected to a first end of an excavation pipe;

an internal shaft surrounded by the drill head and extending into the excavation pipe,

wherein the drill head is configured to remove cuttings from the hole and move the cuttings within the internal shaft upward from the hole toward the surface; and

wherein the internal shaft of the drill head includes spiral blades disposed therein and configured to move the cuttings upward within the internal shaft upward.

16. The sub-surface drill of claim **15**, wherein the spiral blades of the first excavation pump are rotated to create a force to move the cuttings upward.

17. The sub-surface drill of claim **16**, wherein the spiral blades extend continuously along the excavation pipe.

18. The sub-surface drill of claim **15**, further including a second excavation pump spaced apart and connected to the first excavation pump at a second end of the excavation pipe, the second excavation pump having spiral blades disposed within the internal shaft extending from the first excavation pump.

19. The sub-surface drill of claim **18**, wherein the spiral blades of the second excavation pump are rotated to create a force to move the cuttings upward.

20. The sub-surface drill of claim **15**, further including a series of excavation pumps periodically disposed along the excavation pipe,

wherein each of the excavation pumps include rotatable spiral blades disposed within a section of the internal shaft extending from the first excavation pump to create a force to move the cuttings upward.

21. The sub-surface drill of claim **15**, further including a fluid loop where fluid circulates from the surface down fluid lines into the excavation pipe, exits the excavation pipe to assist in removing cuttings from the hole by the drill head, reenters the excavation pipe through a collection chamber, circulates upward to cool the drill head, and is separated from the cuttings at the surface and is made available for recirculation within the fluid loop.

22. The sub-surface drill of claim **21**, wherein the fluid that exits the excavation pipe forms a fluid column only around the drill head.

23. The sub-surface drill of claim **21**, wherein the fluid that circulates upward is further circulated through a closed loop of a power unit to produce electrical power before being returned to the excavation pipe.

24. A method of in-ground drilling for removing cuttings from a well bore, the method comprising the steps of:

removing cuttings from the well bore beneath a ground surface with a drill head having an internal shaft connected to a first end of an excavation pipe and extending through the excavation pipe; and

transporting the cuttings upward to the surface along the internal shaft, wherein the step of transporting further includes the step of rotating spiral blades within the internal shaft of the drill head to create a force to move the cuttings upward.

25. The method of claim **24**, further including the steps of:

periodically disposing a series of excavation pumps from a second end of the excavation pipe, each excavation pump including spiral blades disposed within a section of the internal shaft extending from the drill head; and

rotating the spiral blades of each excavation pump to create a force to move the cuttings upward.

26. A drill head for removing cuttings from a surface, the drill head comprising:

an internal shaft surrounded by the drill head,

wherein the internal shaft of the drill head includes spiral blades disposed within the internal shaft and configured to move the cuttings away from the cutting surface, and

wherein the drill head is configured to remove cuttings from the surface and move the cuttings within the internal shaft away from the cutting surface.

27. The drill head of claim **26**, wherein rotation of the spiral blades create a force to move the cuttings away from the cutting surface.

28. The drill head of claim **26**, wherein the drill head is motorized and further includes a fluid loop where fluid circulates from fluid lines into a drill head space between the drill head and the internal shaft, exits the drill head space to assist in removing cuttings from the cutting surface by the drill head, reenters the drill head through a collection chamber, circulates upward to cool the drill head, and is separated from the cuttings and is made available for recirculation within the fluid loop.

29. The drill head of claim **26**, further including a drill bit positioned at one end of the drill head, the drill bit comprising:

a central drill bit connected to the internal shaft, and

a peripheral drill bit connected to a cylinder wall of the drill head,

wherein the central drill bit and the peripheral drill bit are rotatable relative to each to other to remove cuttings from the surface, and vertically slidable relative to each other to adjust the cutting distance between the central drill bit and the peripheral drill bit.

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